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# The Phonology of Dutch

Geert Booij

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## The Phonology of Dutch

## THE PHONOLOGY OF THE WORLD'S LANGUAGES

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THE  
PHONOLOGY  
OF  
DUTCH

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*Geert Booij*

OXFORD  
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Great Clarendon Street, Oxford ox2 6DP

Oxford University Press is a department of the University of Oxford.  
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Oxford New York

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Published in the United States  
by Oxford University Press Inc., New York

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First published in paperback 1999

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British Library Cataloguing in Publication Data  
Data available

Library of Congress Cataloging in Publication Data

The phonology of Dutch / Geert Booij.  
(The Phonology of the world's languages)  
Includes bibliographical references.

I. Dutch language - Phonology. I. Title. II. Series.  
PF131.B67 1995 439.3'115—dc20 94-34547

ISBN 0-19-823869-X

1 3 5 7 9 10 8 6 4 2

Typeset in Times  
by J&L Composition Ltd, Filey, North Yorkshire  
Printed in Great Britain  
on acid-free paper by  
Biddles Ltd., Guildford and King's Lynn

## PREFACE

This book presents a survey of the phonological system of Dutch. Its primary aim is providing insight into that system as a whole, based on a considerable number of studies in the phonology of Dutch. Thus, this book can function as a reference work that provides access to more detailed studies of aspects of the phonology of Dutch that are available in the linguistic literature.

The analyses proposed are couched in terms of present-day generative phonology, in accordance with the saying that 'description without theory is blind'. Although the book is not primarily meant as an original contribution to phonological theory, the analyses will appear to be relevant for a number of current issues in phonological theory. Moreover, a comprehensive analysis of the phonological system of one language can keep us from too hasty generalizations and theoretical conclusions based on the analysis of just a few phenomena.

A substantial part of the first draft of this book was written while I was a visiting scholar in the Department of Linguistics of the University of Massachusetts in Amherst, from May to July 1992. I would like to express my sincere thanks to all the staff members of the department who made my stay there pleasant and fruitful. In particular, I thank my 'hostess', Lisa Selkirk, and the other two phonologists of the department, John Kingston and John McCarthy, for the inspiring and fruitful discussions I had with them and for their hospitality and helpfulness in practical matters. I also thank the Faculty of Letters of the Vrije Universiteit Amsterdam for making my stay in Amherst possible.

A number of colleagues were so kind as to comment on a previous version of the manuscript: Renée van Bezooijen, Jacques Durand, Carlos Gussenhoven, Ben Hermans, Daan de Jong, René Kager, and Richard Wiese. Their questions and criticisms were very useful.

This book is dedicated to my wife, Herry, and our children, Suzanne, Rebecca, and Indriaas.

## ACKNOWLEDGEMENTS

My thanks are due to Cambridge University Press and to the authors for their kind permission to reproduce figures from Van den Berg, Gussenhoven, and Rietveld (1992).

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## ABBREVIATIONS AND SYMBOLS

<b>A</b>	Adjective <i>or</i> argument	<b>part.</b>	particle
adj.	adjective	<b>pej.</b>	pejorative
ant	anterior	<b>perf.</b>	perfect
appr	approximant	<b>pers.</b>	person <i>or</i> personal
asp.	aspirated	<b>pl.</b>	plural
attr.	attributive	<b>poss.</b>	possessive
<b>C</b>	Clitic Group <i>or</i> Coda <i>or</i> consonant	<b>PP</b>	Prepositional Phrase
cont	continuant	<b>pres.</b>	present
cons	consonant	<b>pron.</b>	pronoun
<b>Cor</b>	Coronal node	<b>PVA</b>	Progressive Voice Assimilation
<b>CSR</b>	Compound Stress Rule	<b>R</b>	Rhyme
def.	definitive	<b>rnd</b>	round
denom.	de-nominal	<b>RVA</b>	Regressive Voice Assimilation
dimin.	diminutive	<b>SAAR</b>	Sentence Accent Assignment Rule
dist	distributed	<b>sg.</b>	singular
<b>Dors</b>	Dorsal node	<b>son</b>	sonorant
<b>EM</b>	extrametrical	<b>SSC</b>	Syllable Structure Condition
<b>F</b>	foot <i>or</i> French	<b>SSG</b>	Sonority Sequencing Generalization
fem.	feminine	<b>subj.</b>	subject
<b>G</b>	Germanic	<b>suff.</b>	suffix
<b>H</b>	high (tone)	<b>u</b>	unstressable
<b>HGI</b>	Homorganic Glide Insertion	<b>U</b>	Utterance
inf.	infinitive	<b>UAC</b>	Uniform Applicability Condition
<b>IP</b>	Intonational Phrase	<b>V</b>	Verb <i>or</i> vowel
<b>L</b>	low (tone)	<b>voc</b>	vocoid
<b>Lab</b>	Labial node	<b>α</b>	variable ranging over + and – (showing agreement in these values)
<b>lat</b>	lateral	<b>σ</b>	syllable
<b>M</b>	modifier	<b>φ</b>	Phonological Phrase
<b>MP-rule</b>	morpholexical rule	<b>ω</b>	Prosodic Word
<b>MSC</b>	morpheme structure condition	<b>Ø</b>	zero
<b>MSR</b>	Main Stress Rule	<b>/ /</b>	phonemic representation
<b>masc.</b>	masculine	<b>[ ]</b>	phonetic representation
<b>n.</b>	neuter	<b>`</b>	main stress
<b>N</b>	Noun <i>or</i> Nucleus	<b>˘</b>	secondary stress
<b>NP</b>	Noun Phrase	<b>H%</b>	High boundary tone
<b>NSR</b>	Noun Phrase Stress Rule	<b>L%</b>	Low boundary tone
<b>O</b>	Onset		
<b>obj.</b>	object		
<b>OCP</b>	Obligatory Contour Principle		
<b>P</b>	predicate <i>or</i> Preposition		
<b>P-rule</b>	phonological rule		

## INTRODUCTION

Dutch is the native language of most inhabitants of the Netherlands, which means that it has about 14 million native speakers in this country. Dutch belongs to the West Germanic branch of the Germanic languages. The West Germanic languages can be divided into two subgroups, Dutch and German versus Frisian and English.

Dutch is indeed similar to German. As far as syntax is concerned, both have two basic word orders, SVO in main clauses, and SOV in embedded clauses; also, both languages exhibit the phenomenon of Verb Raising (raising of a verb or verbal projection from an embedded clause to the dominating clause). On the other hand, Dutch is different from German in that it does not have such a rich inflectional morphology; there is no morphological expression of case except for pronouns that have specific object forms, and it has only two genders, neutral and non-neutral.

The Dutch name for Dutch is *Nederlands*.<sup>1</sup> It is the official language of the Netherlands, but, in Friesland, Frisian is the second official language, which has certain rights in education and local government. Dutch is also one of the three official languages of Belgium, besides French and German. Dutch is spoken in the northern part of Belgium, in the provinces of West-Vlaanderen and Oost-Vlaanderen, Antwerpen, Limburg, and Brabant (that is bilingual) and it has about 6 million speakers there. The capital of Belgium, Brussels, is bilingual (Dutch and French). This means that there are about 20 million native speakers of Dutch in Europe.

Standard Dutch is used both in the Netherlands and in Belgium in the media, in government, and in education. However, Belgian native speakers differ in the extent to which their Dutch differs from the standard Northern Dutch as spoken in the Netherlands. Some of them speak a variety that is almost identical to Northern Dutch, but most of them speak a kind of Dutch that is rather different from standard Northern Dutch in its syntax, morphology, phonology, and vocabulary. This variety is called Southern Dutch (*Zuid-Nederlands*).<sup>2</sup>

<sup>1</sup> The word *Hollands* is also used, because The Netherlands is also referred to as *Holland*, but strictly speaking the word *Holland* refers to two western provinces of Holland, Noord-Holland and Zuid-Holland, which are economically and culturally dominant, and where one finds most speakers of standard Dutch.

<sup>2</sup> Southern Dutch is sometimes called *Flemish* (*Vlaams*), but this is incorrect since Flemish is a set of dialects as spoken in the province of Vlaanderen, the largest of the Dutch-speaking provinces of Belgium.



In one of the twelve provinces of the Netherlands, Friesland, about 400,000 people (73 per cent of the population) speak Frisian,<sup>3</sup> but these Frisians also speak Dutch, i.e. they are bilingual. A substantial number of speakers of Dutch are bilingual in that they also speak a local dialect. In Belgium we find Flemish, Brabantish, and Limburgian. There is also a great variety of dialects in the Netherlands, some of which are similar to High German (for example, Limburgian as spoken in the southern part of the province of Limburg), or to Low German (for example, the north-eastern dialects near the German border).

For many speakers, their Dutch is coloured to some extent by the rural or urban dialect that they speak. These regional variants of Dutch are called regiolects, and they must be seen as intermediate language varieties, in between standard Dutch and specific dialects. Nowadays, younger people often appear to speak only such regiolects rather than specific dialects, in particular in the cities.

Dutch is also spoken in former colonies of the Netherlands, Surinam and the Dutch Antilles, where it is the language of the government, and also used in education. However, there are only very few people in these countries for whom Dutch is their native language. As may be expected, there are specific Surinamese and Antillian varieties of Dutch. In Indonesia, another former colony of the Netherlands, Dutch only plays a role in that some law codes are still only available in Dutch. Remnants of spoken Dutch are found among Dutch immigrants in the USA (American Dutch), Canada, New Zealand, and Australia.

Dutch also has a daughter language, Afrikaans, spoken in South Africa, both as a native and as a second language. It is also spoken in Botswana, Namibia, and Zimbabwe, and has about 5 million native speakers. Afrikaans derives from seventeenth-century urban dialects of Dutch, as spoken by the first settlers in Cape Town, but was also influenced by Malay-Portuguese, and English.<sup>4</sup>

The phonology of Dutch presented in this book is the phonology of standard Northern Dutch.

The first detailed twentieth-century study of the Dutch sound system is a traditional handbook on the phonetics of Dutch, Zwaardemaker and Eijkman (1928). In the 1930s, structuralists like N. van Wijk and A. W. de Groot contributed to the study of the phonology of Dutch (for instance, Van Wijk 1939). The only monograph-size structuralist phonology of Dutch is Cohen *et al.* (1959). An often reprinted textbook is Van den Berg (1958).

The study of the phonology of Dutch was boosted enormously through the rise of generative phonology, as will be clear from the references given in this book (cf. Booij 1990*b* for a historical survey). Two introductions to the

<sup>3</sup> Cf. Tiersma (1985) for a survey of the phonology and syntax of Frisian.

<sup>4</sup> Descriptions of the phonology of Afrikaans can be found in Wissing (1982) and Combrink and De Stadler (1987).

generative phonology of Dutch have appeared, Trommelen and Zonneveld (1979) and Booij (1981*a*). Zonneveld *et al.* (1980) is a collection of papers on Dutch phonology with the explicit aim of showing that Dutch is an interesting object language for theoretical controversies. Nevertheless, a generative phonology-oriented monograph on the phonological system of Dutch written in English was still lacking.<sup>5</sup> This book is meant to fill this gap.

<sup>5</sup> In the first half of this century some linguists were able to read Dutch. For instance, Edward Sapir reviewed publications by C. C. Uhlenbeck on Amerindian languages written in Dutch in the first volume of *International Journal of American Linguistics* (Sapir 1917), and Van Wijk, in his preface to Van Wijk (1939), just presupposed that the fact that this book was written in Dutch did not impede its being read by his colleagues. Bloomfield wrote a short grammar of Dutch for the US army.

## THE SOUNDS OF DUTCH: PHONETIC CHARACTERIZATION AND PHONOLOGICAL REPRESENTATION

### 2.1. INTRODUCTION

In this chapter I will first present a survey of the vowels and consonants of Dutch, and a phonetic characterization of each of them.<sup>1</sup> Subsequently, I will discuss some crucial insights of present-day generative phonology as to phonological features and multi-tiered phonological structure, and use these insights in proposing phonological representations for the sounds of Dutch, which will form the basis for the analysis of the phonological processes of Dutch in the following chapters.

### 2.2. THE VOWEL SYSTEM

Dutch has sixteen vowels, which can be classified as in Table 2.1.

TABLE 2.1. *The Dutch vowels*

Short vowels	ɪ, ɛ, ɔ, ʏ, ʊ
Long vowels	ī, y, u, ē, ø, o, a
Schwa	ə
Diphthongs	ɛi, æy, ɔu

Fig. 2.1 represents the positions of the non-diphthongal (= steady-state) vowels in the stylized vowel space. The vowels are usually distinguished from each other in terms of their place of articulation (as shown in Fig. 2.1), roundedness, and length. Length, however, is not a purely phonetic property: the main reason for distinguishing seven long vowels is a phonological one: the long vowels behave as two 'units', whereas the short vowels behave as one unit (cf. Moulton 1962 and Section 2.5.1). In particular, whereas

<sup>1</sup> A systematic comparison between the phonetics of Dutch and the phonetics of English is given in Gussenhoven and Broeders (1976). Gussenhoven (1992c) is an illustration of the International Phonetic Alphabet for Dutch.

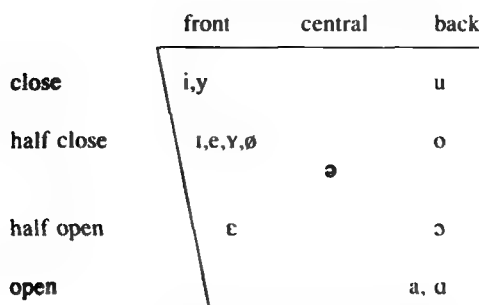


FIG. 2.1. The Dutch vowel space

the non-close long vowels have an average duration of about 200 msec., the short vowels and the high long vowels /i, y, u/ have an average duration of about 100 msec. (Nootboom 1972: 45-7). On the other hand, before /r/ the high vowels do have the same (extra) length as the other long vowels. Thus, we seem to have a 'clash' here between the phonetic and the phonological classification of speech sounds. Below I will make a proposal as to how to account for this.

The long vowels /e/ and /o/ are not only longer than their short phonological counterparts /ɛ/ and /ɔ/, but they also differ with respect to height: the long vowels are higher. Phonetically, the short counterpart of /e/ is /ɪ/. The /y/ is the short counterpart of /ø/. Finally, the /a/ is more central than the /ɑ/.

The schwa occupies the central place in the vowel space. It is similar to the /y/ but pronounced more centrally and without rounding. The defining characteristics of the schwa are again primarily phonological ones: for instance, it can occur in word-final position, unlike the (other) short vowels, and it never bears stress (except in cases where function words such as *de* /də/ 'the' are emphatically stressed).<sup>2</sup>

The three diphthongs are characterized by the transition of a lower position in the vowel space to a higher position. That is, the two constituents only differ with respect to height. Their position in the vowel space is represented in Fig. 2.2.<sup>3</sup>

In standard Dutch the long mid vowels /e, ø, o/ also receive a slightly diphthongal realization: at the end of their articulation there is a transition to the positions of /i/, /y/, /u/ respectively.<sup>4</sup>

In addition to the vowels discussed so far, Dutch also has marginal vowels, occurring in loan-words. The first set comprises phonetically long counterparts

<sup>2</sup> Cf. Stutterheim (1978) for a survey of the discussion between Dutch phonologists concerning the status of the schwa.

<sup>3</sup> Cf. 't Hart (1969) and Koopmans-van Beinum (1969) for detailed phonetic information about these three diphthongs.

<sup>4</sup> In non-standard variants we do find the purely monophthongal realizations of these vowels.

	Front	Central	Back
Close	i y		u
Half close	↑ ↑		↑
Half open	ɛ œ		ɔ
Open			

FIG. 2.2. The Dutch diphthongs

of native phonetically (but not always phonologically!) short vowels, as illustrated in (1). They only occur in stressed syllables:

- (1) [i:] analyse 'analysis'  
 [y:] centrifuge 'spinner'  
 [u:] rouge 'blusher'  
 [ɛ:] enquete 'inquiry'  
 [œ:] oeuvre 'id.'  
 [ɔ:] zone 'id.'  
 [ɑ:] basketball 'id.'

The second set of marginal vowels consists of nasal vowels that occur in some words borrowed from French:

- (2) [ɛ̃] enfin 'anyway'  
 [œ̃] parfum 'perfume'  
 [ɔ̃] chanson 'id.'  
 [ɑ̃] restaurant 'id.'

### 2.2.1. Allophonic variation

All long steady-state vowels are lengthened before /r/, if the vowel and the following consonant belong to the same (prosodic) word. In addition, the /r/ also has a centralizing effect. In other words, long vowels tend to end in a schwa-like sound in this position. The lengthening effect is particularly strong for the high vowels: before the /r/ they have the same length as the non-high long vowels.<sup>5</sup> This centralizing effect opposes the diphthongal realization (raising in the last stage of articulation) of the long mid vowels, and hence the difference in 'colour' between the normal realization of the long mid vowels and that before /r/ is rather strong. This centralizing effect of the /r/ also explains why diphthongs cannot be followed by a tautosyllabic /r/: the realization of diphthongs requires raising in their second phase as opposed to

<sup>5</sup> The only exceptions are the past-tense forms of a few verbs, in which the /i/ remains short, e.g., *wierp* [wirp] 'threw', *stierf* [stirf] 'died', *zwierf* [zwirf] 'wandered', *bedierf* [bədɪrf] 'spoiled'.

centralization. After vowels followed by /j/ or /v/ we get the transitional vowels [i] and [u] respectively, which is sometimes reflected in Dutch spelling, as in *Booij* /boj/ 'id.' and *nieuw* /niu/ 'new'.

The diphthongs /ɛi/ and /œy/ cannot be followed by a /v/ in the same syllable, nor /ɔu/ by a tautosyllabic /j/, probably because the final stage of the diphthong requires an articulatory gesture with respect to backness which is the opposite of that of the next glide.

Before the nasal consonants, the vowel /ɔ/ is closer and more centralized than in other positions, i.e. it is pronounced as [ʊ] in that position. We also find this realization of /ɔ/ in some other words, for example, *op* [ʊp] 'on' versus *mop* [mɔp] 'joke'. There is, however, geographical and individual variation with respect to this phonetic variation.<sup>6</sup>

### 2.3. THE CONSONANT SYSTEM

The consonants of Dutch are given in Table 2.2.

TABLE 2.2. *The consonants of Dutch*

	Bilabial	Labio dental	Alveolar	Palatal	Velar	Glottal
Plosives	p, b		t, d		k, (g)	
Fricatives		f, v	s, z		x, ɣ	h
Nasals	m		n		ŋ	
Liquids			l, r			
Glides		ʋ		j		

The [g] is put in parentheses because it only occurs in non-native words such as *goal* 'id.' (football term), and as the contextual allophone of /k/ before a voiced plosive, as in *zakdoek* [zʌgduk] 'handkerchief'. The alveolar consonants /s, z, t, n/ are palatalized before /j/, and then realized as the postalveolar or prepalatal sounds [ʃ, ʒ, ɕ, ɲ] respectively. The postalveolar fricatives also occur in loan-words, as in *chique* [ʃik] and *jury* [ʒy:ri], but phonologically they can also be considered as combinations of /s, z/ and /j/, with the fricatives predictably being realized as the postalveolar allophones.<sup>7</sup>

For many speakers of standard Dutch, in particular in the western part of Holland, the voiced-voicelessness distinction between /f/ and /v/ and /x/ and /ɣ/ is neutralized at the beginning of a word, and sometimes also intervocalically

<sup>6</sup> Cf. Schouten (1981) for a discussion of this phenomenon.

<sup>7</sup> Collins & Meeus (1981) also consider /dʒ/ and /tʃ/ as in *jeep* [dʒip] 'id.' and *chip* [tʃip] 'id.' as non-native consonants of Dutch. However, they can also be analysed as sequences of consonants, /dʒj/ and /tʃj/ respectively.

(word-finally, obstruents are always voiceless). In these cases, the voiceless variants are used.<sup>8</sup> Note, however, that even for these speakers there must be an underlying distinction between voiced and voiceless fricatives, at least morpheme-finally, because this distinction still plays a role in the selection of the proper past tense suffix of verbs: /də/ after voiced segments, /tə/ after voiceless obstruents, for example, *legde* [lɛxdə] 'laid' versus *lachte* [lɛxtə] 'laughed', and *draafde* [dravdə] 'raced' versus *mafte* [maftə] 'slept'.<sup>9</sup>

The /h/ is a voiced consonant, articulated with glottal friction, with the same shape of the vocal tract as that of the following vowel.<sup>10</sup>

The articulation of the velar fricatives varies from postvelar to postpalatal. The latter variant is characteristic for speakers from the southern parts of the Netherlands and the Dutch speaking area of Belgium. The /x/ is often also palatalized before /j/ as in *wiegje* [wiçjə] 'cradle'. Speakers of the Western variety of Dutch also realize it as a uvular fricative [χ].

The /l/ is usually realized as a rather clear [l] before vowels in word-initial position, with an alveolar contact, and as a dark (velarized) [ɫ] in syllable rhymes and intervocally. Some speakers even realize the /l/ as a vocoid in that position.<sup>11</sup>

The /r/ may be realized as an alveolar roll [r] (in particular in utterance-initial position), as an alveolar flap [ɾ], as a uvular roll [ʀ], as a uvular fricative [χ], or as a uvular approximant [ʁ]. In postvocalic position /r/ may also be realized as a palatal approximant similar to [j]. This is a matter of individual and regional variation.<sup>12</sup>

The /v/ is a labiodental approximant. In coda position, it is realized as a bilabial vocoid, without contact between the two articulators, as in *nieuw* [niu] 'new', *leeuw* [leu] 'lion', and *ruw* [ryu] 'rough'. As we will see in Chapter 3, it forms indeed a natural class with the vocoid /j/ in that position. After back vowels before a next vowel we get insertion of a homorganic glide [ɥ], as in *gnoen* [ɣnuən] 'gnus'. In other positions it is a labiodental approximant, for example, in *water* /vatər/ 'id.' and *wreed* /vred/ 'cruel'. In the south of the Netherlands and in Belgium, the bilabial approximant [β] is used instead of the labiodental approximant (cf. Zwaardemaker and Eijkman 1928: 154–5, Gussenhoven and Broeders 1976: 54–5).

The /j/ is a palatal vocoid, with the same phonetic properties as the [i] except

<sup>8</sup> This variation is discussed in Gussenhoven and Bremmer (1983). It may be that the distinctive role of voice is taken over by the opposition fortis–lenis (Debrock 1978). The distinctive role of voice for fricatives is also discussed in Slis and Van Heugten (1989). Historical aspects are discussed in Dekeyser (1978). Information on the phonetic realization of voiced stops is given in Slis and Cohen (1969).

<sup>9</sup> This argument was given in Kager (1989: 221).

<sup>10</sup> The Dutch /h/ differs from the English /h/ in that it is voiced whereas the English /h/ is voiceless, cf. Anderson (1986). Phonetically, however, it may have a partially voiceless realization (Rietveld and Loman 1985).

<sup>11</sup> Cf. Van Reenen (1986) for some more information on the vocoid realization of the /l/.

<sup>12</sup> A survey of the different pronunciations of the /r/ is given in Gussenhoven and Broeders (1976: 127) and in Collins and Mees (1981: 168–71).

that it occurs in consonantal positions in the syllable; it has a shorter duration than the [i].

## 2.4. PHONOLOGICAL FEATURES

A fundamental insight of present-day generative phonology is that the sounds of a language are not atomic, indivisible units, but should be decomposed into sets of phonological features (Chomsky and Halle 1968, Halle 1991). In Chomsky and Halle (1968) each segment is represented as a simple set of co-occurrent binary phonological features such as [–voice], [+nasal]. However, in Clements (1985) and subsequent work, it has been argued that the set of phonological features should be internally structured. For instance, place features must be assumed to form a subunit of features since cross-linguistically they behave as a unit in assimilation processes such as the assimilation of nasal consonants to the following consonant with respect to place of articulation.

In this book I assume the feature geometry for Dutch given in Fig. 2.3, based on proposals by Clements (1985), Sagey (1986), McCarthy (1988), Halle and Ladefoged (1988), and Halle (1991).

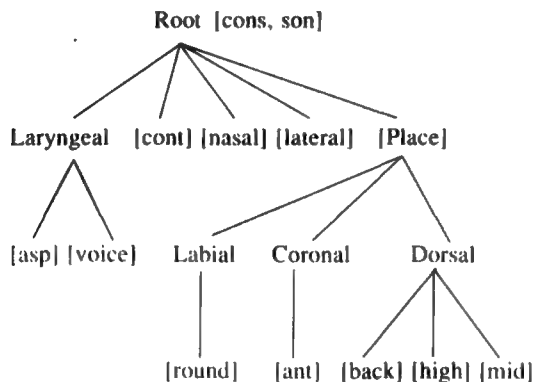


FIG. 2.3. The feature geometry of Dutch

The root node represents the phonological unity of the features that form together a phonological segment. The root node is annotated with the binary features [consonant] and [sonorant], the so-called major class features that divide the segments of a language into three classes:

- |                   |                     |
|-------------------|---------------------|
| (3) [+cons, –son] | obstruents          |
| [+cons, +son]     | sonorant consonants |
| [–cons, +son]     | vowels              |



Moreover, the feature [consonant] divides the segments into consonants versus vowels, and the feature [sonorant] divides them into obstruents and non-obstruents. The feature [consonant] specifies the difference in the degree of stricture of the vocal tract between vowels and consonants. Segments with the feature [+consonant] are consonants, segments with the feature [−consonant] are vowels. The latter have a free escape of the airstream. The feature [sonorant] also pertains to the degree of stricture in the vocal tract, and distinguishes stops and fricatives from the other consonants and the vowels.<sup>13</sup> In addition to these major class features we also need the feature [approximant], as will be made clear in Section 3.3: obstruents and nasal consonants are [−approximant], the other segments are [+approximant].

#### 2.4.1. *Laryngeal features*

Laryngeal is a so-called class node, which unites features with respect to the ways in which the larynx is used in articulation. The basic laryngeal distinction for Dutch is that between voiced and voiceless segments. The feature [voice] is only distinctive with respect to obstruents: vowels and sonorant consonants are always voiced in Dutch. In this book I will take the conservative position that the terminal nodes in feature geometry are binary features, and therefore voiced segments are described as [+voice], and voiceless segments are [−voice].<sup>14</sup>

The feature [aspirated] can be used to characterize the /h/, a voiced glottal fricative. Aspirated sounds are produced with the vocal cords drawn apart, which gives a non-periodic (noise) component in the acoustic signal. The /h/ does not have supralaryngeal properties of its own, the shape of the vocal tract being determined by that of the following vowel. Therefore, the phonological representation of the /h/ consists of a root node that only dominates Laryngeal specified as [+aspirated]. All other segments are [−aspirated].<sup>15</sup>

#### 2.4.2. *Supralaryngeal features*

Supralaryngeal features are traditionally divided into manner features and place features. The manner features comprise [continuant], [nasal], and [lateral]. The feature [continuant] applies as follows: nasals, oral stops, and laterals are [−continuant], the other consonants and vowels are [+continuant].

<sup>13</sup> 'Sonorant sounds are produced with a vocal tract configuration sufficiently open that the air pressure inside and outside the mouth is approximately equal. Obstruent sounds are produced with a vocal tract constriction sufficient to increase the air pressure inside the mouth significantly over that of the ambient air.' (Halle and Clements 1983: 6.)

<sup>14</sup> Alternatively, one may assume that some features are privative or monovalent. For instance, Mester and Itô (1989) and Lombardi (1991) proposed that the feature [voice] is a privative feature. This makes the prediction that phonological rules can only refer to the property of voicedness, not to voicelessness. Whether this prediction can be upheld, is a matter for further research.

<sup>15</sup> This suggests that [aspirated] may be interpreted as a privative feature.

In the production of continuants the vocal tract has such a form that the airflow through the midsagittal region of the oral tract is not interrupted. In the production of nasals, the nasal cavity is opened during the production.<sup>16</sup>

Although 'supralaryngeal' is a convenient term, this does not mean that it is a class node: sufficient evidence for the supralaryngeal features behaving as a unit is lacking (McCarthy 1988).

On the other hand, Place clearly is a class node because the cluster of place features may behave as a unit in phonological processes, for instance in place assimilation for nasal consonants.

In Dutch, three articulators play a role with respect to the place of articulation, the lips (labia), the tongue blade (corona), and the tongue body (dorsum). The relevant Place features are privative by nature.

The lips play an essential role in the articulation of the labiodental consonants /f, v, ʋ/, and the bilabial consonants /p, b, m/. The phonetic difference between labiodentals and bilabials does not play a phonological role, and this difference can therefore be spelled out by a phonetic detail rule.

The class node Coronal refers to constrictions made with the corona, the tongue blade, as the active articulator. The alveolar consonants are furthermore [+anterior] whereas the postalveolar consonants are [-anterior]. Non-anterior sounds are produced with a constriction behind the alveolar ridge. There is no distinctive class of [-anterior] coronal consonants in Dutch, they are allophones of [+anterior] consonants before /j/, and the specifications for this feature are therefore predictable. Another binary feature that is dependent on the class node Coronal is [distributed]. The postalveolar coronal consonants of Dutch are predictably [+distributed] which means that they 'are produced with a constriction that extends for a considerable distance along the midsagittal axis of the oral tract; nondistributed sounds are produced with a constriction that extends for only a short distance in this direction' (Halle and Clements 1983: 6). So [-distributed] correlates with the phonetic feature 'apical', and [+distributed] with the notion 'laminal'. Such specifications do not belong to the phonological representations of these sounds, but are to be predicted by redundancy rules.

Palatal and velar consonants are produced by means of a constriction at the dorsum. The palatal glide /j/ is [-back],<sup>17</sup> the velar consonants and the uvular

<sup>16</sup> As far as Dutch is concerned, it is possible to consider the feature [nasal] as privative. This correctly predicts that there are no rules of Dutch that crucially refer to the class of non-nasal segments. The same holds for the feature [lateral] that uniquely characterizes the /l/, in the production of which the air stream does not pass through the centre of the mouth but at both sides of the tongue. However, Steriade (1987) argues in favour of a binary interpretation of [lateral].

<sup>17</sup> In qualifying the [j] as a dorsal glide we follow Chomsky and Halle (1968). Halle (1991) assumes that the glide [j] can be articulated by either the Coronal or the Dorsal articulator. Both Keating (1991) and Lahiri and Evers (1991) argue that the [j] should be represented as a coronal glide, which would also explain the allophonic effect of the /j/ on preceding coronal obstruents more straightforwardly. Since the /j/ is identical to the vowel /i/ as to its phonetic properties, this would have the consequence that front vowels are also Coronal, as indeed proposed by Lahiri and Evers (1991). I leave this issue open here.

[ʀ] are [+back]. Both palatals and velars are [+high], the uvular [ʀ] can be characterized as [+back, -high]. In the lexical forms, there is no need to specify Dorsal consonants for [back] since this is predictable: they are all [+back]. Also, we do not need a phonological feature for uvular [ʀ] because it is an allophone of the alveolar [r].

The dorsum is the main articulator for vowels. The feature [back] distinguishes between front and back vowels, and the features [high] and [mid] account for vowel height. The issue of how to account for vowel height will be discussed in more detail in Section 2.5.2.

Vowels also have to be qualified as either [+round] or [-round]. Since in the articulation of vowels the lips are also involved, these vowels will also be specified for the class node Labial, with the feature [round] dependent on this class node (Sagey 1986).<sup>18</sup>

### 2.4.3. *Underspecification*

Not all phonological properties of a segment need to be represented lexically since certain properties are predictable. A classic example is the place of articulation of nasal consonants before a following non-coronal consonant, which can be predicted by a phonological rule of Place assimilation.

A second category of rules is formed by rules that predict feature specifications of a certain segment on the basis of other feature specifications of that segment, so-called segment structure rules. For instance, the following redundancy rules hold for the segments of Dutch:

- |             |   |                             |
|-------------|---|-----------------------------|
| (4) [-cons] | → | [+appr]                     |
| [+appr]     | → | [+son]                      |
| [+son]      | → | [+voice, +cont]             |
| [+nas]      | → | [+cons, +son, -appr, -cont] |
| [-son]      | → | [+cons, -appr]              |
| [+asp]      | → | [+cons]                     |
| [+lat]      | → | [+cons, +son, +appr]        |

Rules that predict major class features are crucial for the proper application of syllabification rules. Therefore, it is clear that such rules have to apply before the phonological derivation starts. I will assume that rules apply as soon as possible, unless stated otherwise.

Another case of redundancy is that of the feature [+voice], which is predictable for sonorants. Yet, it must be available before the end of the phonological derivation, for instance because there is a postlexical rule in Dutch that voices word-final fricatives before vocoids (cf. section 7.2.1). There is also a lexical rule that spreads the feature [+voice] of sonorants to the initial consonant of the past-tense suffix (cf. Section 4.2). In other words,

<sup>18</sup> For critical comments on this position, see Odden (1991).

underspecification cannot always be interpreted as 'the perseverance of underspecified segments during the course of a derivation' (Archangeli 1984: 189), and as the filling in of the relevant specifications at the end of the phonological derivation.<sup>19</sup> In this book, I will assume that predictable features are specified before the application of the phonological rules of Dutch, unless explicitly stated otherwise.

Underspecification is also relevant in specifying the /v/. It suffices to specify it as a labiodental approximant at the underlying level. It is predictable that it is a vocoid after vowels, as in *nieuw* /niv/ 'new', and the feature [+vocoid] (cf. Section 3.3) will be filled in immediately, because certain syllable-structure constraints refer to [vocoid]. Moreover, as observed by Gussenhoven and Broeders (1976: 55), the /v/ remains vocoid after the addition of an inflectional schwa, as in *nieuwe* /nivə/ 'new' as follows from filling in the value [+vocoid] as soon as possible, i.e., before the addition of the inflectional schwa. In all other positions, the /v/ will be specified as [–vocoid].

Certain consonants bear specifications that make it possible to uniquely identify them by means of one or two features. For instance, [+lateral] uniquely identifies the /l/, [+aspirated] the /h/, and each nasal consonant is uniquely identified by [+nasal] plus its Place feature.

In Section 2.6 I will give a survey of the phonological specifications for Dutch consonants at the lexical level.

## 2.5. THE REPRESENTATION OF VOWELS AND DIPHTHONGS

In this section I will discuss the phonological representation of vowels and diphthongs on the basis of the feature system introduced in Section 2.4.

### 2.5.1. Vowel length

Although Dutch has a systematic opposition between short and long vowels (except for high vowels), the feature system introduced above does not contain a feature for length. The reason for this is that there are good arguments for representing length in structural terms rather than by means of a binary feature.

It is generally accepted that Dutch short vowels count as one 'unit', and long vowels as two (Moulton 1962). In a syllable, a short vowel can be followed by at most two consonants, but after a long vowel only one consonant can occur. For instance, *damp* [damp] is a possible syllable, whereas *daamp* [damp] is not. To account for this difference, it has been proposed that long vowels are represented as sequences of two identical [–consonant] segments (Zonneveld and Trommelen 1980).

<sup>19</sup> Cf. Mester and Itô (1989), Mohanan (1991), McCarthy and Taub (1992), and Hall (1993) for a critical evaluation of theories of underspecification.

In non-linear phonology as developed in McCarthy (1981), Clements and Keyser (1983), and Levin (1985) it has been argued that phonological representations consist of at least two tiers, a skeletal tier and a melodic tier. The skeletal tier represents the abstract units to which the units at the melodic tier are linked, not necessarily in a one-to-one fashion. The phonological representations of the words *kap* [kap] 'cap' and *kaap* [kap] 'cape' will then be as follows (where the letters at the melodic tier stand for the feature bundle of a segment):

(5) skeletal tier	X X X	X X X X
		∨
melodic tier	k a p	k a p

In other words, vowel length is represented as the linking of two elements on the skeletal or X-tier to one element on the melodic tier. A representation of long vowels as in (6):

(6) X X
a a

is forbidden by the Obligatory Contour Principle (OCP) (McCarthy 1986), which says that identical adjacent elements on the melodic tier are prohibited. In other words, the OCP requires us to represent long vowels as doubly linked melodic elements.

A desirable consequence of excluding representations like (6) is that at the melodic level long vowels are still represented as a unit. This is confirmed by the behaviour of long vowels with respect to certain phonological processes. Dutch vowels in unstressed syllables can be reduced to schwa. For instance, the word *banaan* /banan/ 'banana', with stress on the second syllable, can be pronounced as [bənən]. This reduction process always affects the whole long vowel, not only part of it. So we do have reduction of long [a] to schwa, but not to something like [uə]. The reduction process can now be straightforwardly characterized as delinking of the Place specification of the vowel as represented in (7), and subsequent filling in of the Place features of the schwa by a default rule:

(7) Vowel Reduction	[-cons]
	⊥
	Place (in unstressed syllables)

The horizontal lines through the association line indicate delinking. That is, the Place features are removed from the vowel, which is now unspecified for Place.

If we assumed long vowels to consist of two identical vowels, we would have to add a special proviso to the rule of Vowel Reduction that once one of

the vocalic segments has been reduced, the other one has to be reduced as well. Moreover, note that the reduction always results in one schwa, not in two.

The representation of long vowels as one melodic unit linked to two X-positions thus nicely accounts for the dual nature of long vowels. It also enables us to give an adequate characterization of diphthongization processes. It has long been noted that diphthongs normally arise out of long vowels (Hayes 1990). In the framework used here this is readily interpretable: in diphthongization the two Xs, which first shared all features, get different features for a certain dimension, often height, and therefore, the long vowel splits up into two melodic units, each linked to an X-position (Sluyters 1992).

Another logical possibility is representing the length distinction by means of a binary feature [length]. However, such an approach does not explain why long vowels behave like two units in co-occurrence restrictions, and why it is long vowels that diphthongize.

The lexical distinction between short and long vowels will therefore be expressed in the lexicon as in (8):

- (8) [a]    X        [a]    X X  
           |            |  
           a            a

The vowels /i, y, u/ have two X-positions, although they are phonetically short, except before /r/. Phonologically they behave like long vowels. First, like (other) long vowels, they allow for only one consonant to follow them in the same syllable: syllables such as the following are ill-formed:

- (9) \*/kimp/, \*/kypm/, \*/kump/, \*/kilm/, \*/kylm/, \*/kulm/

Second, unlike short vowels, they can occur in word-final position. Third, when they occur in the word-final syllable, they select the same allomorph of the diminutive suffix as words with a long vowel in their word-final syllable (see Chapter 4):<sup>20</sup>

- (10) traan 'tear'—traantje, schoen 'shoe'—sch[u]ntje *versus* pan 'pan'—  
       p[ʌ]nnetje  
       raam 'window'—raampje, riem 'belt'—r[i]mpje *versus* bom 'bomb'—  
       b[ɔ]mmetje  
       meer 'lake'—meertje, buur 'neighbour'—b[y:]rtje *versus* ster 'star'—  
       st[ɛ]rretje

A question that remains to be answered in this connection is how we account for the difference in length between the 'normal' and the marginal high

<sup>20</sup> However, there are a few exceptional cases in which nouns with /i/ or /u/ in the word-final syllable select the allomorph that normally occurs with short vowels, such as *bloemetje* 'bunch of flowers' (cf. Van Haeften 1958, Heeroma 1959). Trommelen (1987) mentions some other marginal phenomena in which high vowels, in particular in non-native words, seem to behave as short vowels. Historically, the long and the short /i/ have merged in standard Dutch. In some dialects of Dutch, there is still a length difference for /i/ and /u/ with a distinctive function.

vowels. For instance, in the loan-word *team* 'team' [ti:m] the vowel is phonetically long, in contrast to the vowel of *tien* 'ten' [tin]. Following a proposal by Smith *et al.* (1989) and Hermans (1992), I will represent the difference between [i] and [i:] as a difference in linking:

- (11) [i] X X      [i:] X X  
           |                \/  
           i                i

Both vowels will function as branching nuclei, but the second X of /i/ does not receive a phonetic interpretation, because it is not linked to the melodic tier. Hence, the /i/ surfaces as a short vowel, except before /r/. In non-high vowels, which are phonetically long, the segment will be linked to the second X by a rule (cf. Section 2.5.2).

Interestingly, there is a length alternation in pairs of related words such as

- (12) *analýse* [ana'li:zə] 'analysis'  
       *analyséer* [anali'ze:r] 'to analyse'
- centrifúge* [sɛntri'fy:ʒjə] 'spinner'  
       *centrifugéer* [sɛntrify'ʒe:r] 'to spin-dry'

A related alternation is to be observed for non-high marginal vowels, as in

- (13) *géne* ['ʒjɛ:nə] 'shame'      *genéer* [ʒjə'ne:r] 'to feel ashamed'  
       *zóné* ['zɔ:nə] 'id.'      *zonéer* [zo'ne:r] 'to divide into zones'

In the latter case, the marginal vowels turn into their native counterparts in unstressed position. It is now possible to account for these alternations by means of a rule (14) that delinks the second X from the melodic tier in unstressed position.

- (14) X X  
           \\*  
       [–cons] in unstressed syllables

In the next section (2.5.2) it will be shown how delinking implies raising rather than shortening for non-high vowels.

### 2.5.2. Vowel height

Chomsky and Halle (1968) used the binary features [high] and [low] for vowel height. Thus they can distinguish between three degrees of vowel height, since the combination [+high, +low] is logically impossible. Wang (1968) pointed out, however, that there are languages for which four degrees of vowel height have to be distinguished.<sup>21</sup> Dutch clearly requires four degrees of vowel height

<sup>21</sup> The same point is made by Kiparsky (1986), Lindau (1978), Clements (1989), and Hayes (1990).

TABLE 2.3. *Vowel height features*

	- back	+ back
+high, -mid	i, i:, y, y:	u, u:
+high, +mid	ɪ, e, ʏ, ø	o
-high, +mid	ɛ, ɛ:, œ, œ:	ɔ, ɔ:
-high, -mid		ɑ, ɑ

at the phonological level if we want to be able to give a proper characterization of the marginal vowels as well. This is possible by using the feature [mid] instead of the feature [low] (Table 2.3).

The /œ/ only occurs as the first half of the diphthong /œy/. An allophonic rule will specify that /ɔ/ is realized as [+high] before nasals.

Certain redundancy rules hold for the system. For instance, low vowels are always [+back], and unrounded back vowels are always low. This can be expressed by the following rules:

- (15) a. [-cons, -high, -mid] → [+back]  
 b. [-cons, -round, +back] → [-high, -mid]

Clearly, the rule system should not contain both rules (15a) and (15b) because they presuppose different lexical specifications: rule (15a) presumes that the height features are lexically specified, and [+back] predictable, whereas rule (15b) presupposes the inverse. This is the case, of course, because feature specifications are mutually dependent. Below I will show that the choice between (15a) and (15b) can be made on empirical grounds, and that (15b) is to be preferred. By contraposition ('p → q' is equivalent to 'not-q → not-p') we can derive a second rule from rule (15b):

- (15) b' [-cons, +back] → [+round] /  $\left[ \begin{array}{c} - \\ \{ +\text{high} \\ +\text{mid} \} \end{array} \right]$

It is also predictable that [+high, -mid] vowels are always long, that is, have two Xs on the skeletal tier.

Furthermore, except for loan-words, it is predictable that long mid vowels are [+high]:

- (16) [-cons, +mid] → [+high] / X X  
 |  
 —

This rule has a dual function: it predicts redundant features, but can also be applied in a feature-changing fashion in derived environments. Dutch has an unproductive rule of vowel lengthening in open syllables (cf. Chapter 4), as illustrated in (17):



- (17) g[ɔ]d–g[o]den            ‘god’–‘gods’  
       sch[t]p–sch[e]pen       ‘ship’–‘ships’  
       w[ɛ]g–w[e]gen          ‘road’–‘roads’

Note that /ɪ/ and /ɛ/ both change into /e/. This follows from rule (16) which will turn the lengthened low /ɛ:/ into the mid vowel /e/. This rule also accounts for the change of the marginal half-open vowels to half-close vowels in unstressed position. The delinking rule (14) creates a derived environment, in which rule (16) can apply, changing the melodic elements [ɛ:] and [ɔ:] into [e] and [o]. In order to account for the phonetic interpretation of non-high vowels with two Xs as long, I assume, with Hermans (1992), the linking rule (18) for non-high vowels that links the melodic element to the second, empty X.<sup>22</sup>

- (18) X    X  
       |    /  
       { +mid }  
       { –high }

The regularity expressed in (15*b*) also plays a role in phonological alternations, and therefore this rule must be preferred above rule (15*a*). Dutch has a rule of Learned Vowel Backing (cf. Chapter 4) that backs vowels in non-native morphemes followed by a non-native suffix:

- |                                 |                                   |
|---------------------------------|-----------------------------------|
| (19) fundamēt[e]l ‘fundamental’ | fundamēt[a]lisme ‘fundamentalism’ |
| milit[ɛ:]r ‘military’           | milit[a]risme ‘militarism’        |
| direkt[ø:]r ‘director’          | direkt[o]raat ‘directorate’       |

Note now that [o] is indeed the back counterpart of the [ø], but that [e] and [ɛ:] not only differ from [a] with respect to the feature [back], but also with respect to vowel height since the backed vowel is low. This is exactly predicted by rule (15*b*), and therefore we must consider this rule as the correct generalization with respect to the relation between backness and roundness for low vowels.

A chart of the underlying feature specifications for vowels is given in Section 2.6 (Table 2.4).

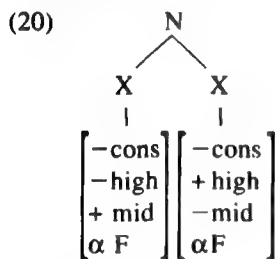
### 2.5.3. Diphthongs

The three Dutch diphthongs /ɛi/, /œy/ and /ɔu/ can be defined as sequences of non-identical vowels that form the (complex) nucleus of a syllable. The three Dutch diphthongs indeed behave distributionally as long vowels in terms of co-occurrence restrictions. They must be distinguished from vowel + glide combinations such as /ɔj/ and /ɔj/ that occur in a few Dutch words such as *mais* /mɔjs/ ‘corn’ and *hoi* /hɔj/ ‘hi’. Diphthongs can be followed by the same

<sup>22</sup> This linking rule also makes it possible to represent all native long vowels as having a second empty X-slot to which the vocalic segment on the melodic tier is not linked underlyingly (cf. Hermans 1992 for arguments in favour of this assumption).

consonants as the long vowels (i.e., all consonants except /h/ and /ŋ/), whereas glides cannot be followed by other consonants (except alveolar obstruents). For instance, /eip/ is fine, but /ajp/ is impossible (Booij 1989a).

The characteristic property of Dutch diphthongs is that the two halves only differ with respect to height. They are identical with respect to [back] and [round]. In other words, two short vowels can only form a complex nucleus in Dutch if the first one is a half-open vowel, and the second one a close vowel. I will therefore represent the three diphthongs as sequences of two short vowels, each linked to one X-position. Their diphthongal nature is then defined by template (20) for proper syllable nuclei (cf. Chapter 3).



In other words, a sequence of two short vowels forms a complex nucleus if the vowels are identical with respect to backness and roundness, and differ in height in the way indicated.

#### 2.5.4. The representation of the schwa

The schwa, although phonetically short, behaves distributionally as a long vowel. Like long vowels, the schwa cannot be followed by a cluster of two consonants in the same syllable, and it can occur in word-final position, which is impossible for short vowels. Hence, we have to assign two skeletal positions to the schwa.<sup>23</sup> Just like the high long vowels, the schwa is phonetically short, and therefore the features of the schwa will only be linked to the first X.

What is the underlying representation of the schwa in terms of features? As pointed out by Trommelen (1984: 77) the schwa does require an underlying representation since its occurrence is not completely predictable by rule on the basis of certain consonantal configurations. The following examples from Trommelen (1984: 77) illustrate this:

- (21) a. lamp 'id.'                      b. henn[ə]p 'hemp'  
       bank 'bench'                    monn[ə]k 'monk'  
       kans 'chance'                  Jann[ə]s 'John'  
       hemd 'shirt'                    lemm[ə]t 'blade'

<sup>23</sup> A similar proposal was made in Trommelen (1984). In Kager (1989) the hypothesis is pursued that the schwa is not linked to an X-slot at the underlying level.

Yet, the schwa can be considered as the unmarked, the default vowel of Dutch: it is the vowel that occupies the central position in the vowel space, it is the vowel to which full vowels can be reduced in unstressed position, and it is the vowel that is optionally inserted in non-homorganic consonant clusters. Phonetically, it is an unrounded central vowel, that is, neither front, back, high, nor low. This cannot be expressed by assuming a feature [+central] for the schwa, since this feature does not play any role in the vowel system of Dutch. In other words, the schwa may not have any phonological specification other than [−consonant].

Note, however, that we have to be able to identify the schwa as such, since there are certain rules that crucially have to identify the schwa, for instance the rule of Prevocalic Schwa Deletion that only applies to schwa. Also, the schwa must be identifiable for stress rules since a syllable with a schwa never bears stress, and the template for well-formed prosodic words of Dutch also refers to the schwa. Therefore, I will represent the Dutch schwa as an empty vowel with the diacritic feature [unstressable], [u] for short, specified on the root. This will make it possible to identify the schwa for the proper application of phonological rules. Therefore, the lexical phonological representation of the schwa will be as follows:

- (22) X X  
       |  
       [−cons]<sub>u</sub>

## 2.6. FEATURE CHARTS FOR VOWELS AND CONSONANTS

The discussion of the phonological representation of Dutch vowels and consonants is summarized by the feature charts (Tables 2.4, 2.5). In these charts, the predictable features are circled. The uncircled feature specifications suffice to distinguish between the different consonants. In this chart, the glide /j/ is not mentioned because it has the same phonological properties as the /i/ except that it has only one position on the X-tier. Features that are either completely predictable or concern allophones, such as [anterior], [distributed], [high], and [back] are omitted.

TABLE 2.4. *Feature chart for Dutch vowels*

	i	y	u	ɪ	e	ɛ	ø	o	ɔ	ɐ	œ	ɑ	a
cons	−	−	−	−	−	−	−	−	−	−	−	−	−
high	+	+	+	+	⊕	+	⊕	⊕	−	−	−	⊖	⊖
mid	−	−	−	+	+	+	+	+	+	+	+	⊖	⊖
back	−	−	+	−	−	−	−	+	+	−	−	+	+
rnd	−	+	⊕	−	−	+	+	⊕	⊕	−	+	−	−

TABLE 2.5. *Feature chart for Dutch consonants*

	p	b	t	d	k	f	v	s	z	x	ɣ	m	n	ɲ	l	r	ʋ	h
cons	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕
son	-	-	-	-	-	-	-	-	-	-	-	⊕	⊕	⊕	⊕	⊕	⊕	⊕
appr	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊕	+	+	⊕
cont	-	-	-	-	-	+	+	+	+	+	+	⊖	⊖	⊖	⊖	⊕	⊕	⊕
voice	-	+	-	+	-	-	+	-	+	-	+	⊕	⊕	⊕	⊕	⊕	⊕	⊕
nasal	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	+	+	+	⊖	⊖	⊖	⊖
lat	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	+	⊖	⊖	⊖
asp	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	⊖	+
Lab	v	v				v	v					v					v	
Cor			v	v				v	v				v		v	v		
Dors					v					v	v			v				

Note. A 'v' indicates that a privative feature is present.

## THE PROSODIC STRUCTURE OF WORDS

### 3.1. INTRODUCTION

Words are not just sequences of sounds, like beads on a string; rather, they are organized into higher order phonological constituents such as the syllable and the prosodic word (also called the phonological word), two fundamental units of prosodic structure that will be discussed in this chapter.

There are three basic roles for the syllable as a phonological unit:

(a) The syllable is the most important domain of phonotactic restrictions, that is, a crucial domain for constraints on the co-occurrence of segments. For instance, we cannot determine whether the consonant sequence /pm/ is well-formed without taking the domain of the syllable into account: the sequence /pm/ is impossible if it belongs to one syllable (is tautosyllabic), whereas it is possible if there is a syllable boundary between the /p/ and the /m/ (i.e., /pm/ is heterosyllabic), as in the Dutch family name *Abma* [apma] that consists of the syllables (ap)<sub>σ</sub> and (ma)<sub>σ</sub>.

(b) The syllable functions as a domain of phonological rules. The classical example from Dutch is the rule of final devoicing (traditionally called *Auslautverhaertung*) that devoices obstruents at the end of a syllable, which is usually formalized as follows:

(1) [-son] → [-voice] / —)<sub>σ</sub>

The effect of this rule is demonstrated by the word pair *hoed* [hut] 'hat'–*hoeden* [hudən] 'hats'. In the singular form the morpheme-final /d/ occurs at the end of a syllable, since the singular form consists of the syllable (hud)<sub>σ</sub>, and hence it is devoiced. In the plural form, on the other hand, which consists of the syllables (hu)<sub>σ</sub>(dən)<sub>σ</sub>, the /d/ is syllable-initial, and therefore it remains voiced. This example also illustrates that morphological structure and syllable structure do not coincide, because the morphological division of *hoeden* is *hoed-en*, *-en* being the plural suffix. This issue will be discussed in greater detail in Section 3.6.

In early generative phonological publications on Dutch, final devoicing was sometimes formulated as a word-final rule, because we only find alternations between voiced and voiceless obstruents in word-final position. Yet, it can be shown that the rule also applies word-internally. First, it applies to acronyms such as *ABVA* (*Algemene Bond van Ambtenaren* 'General Union of Civil Servants'), which is syllabified as (ab)<sub>σ</sub>(va)<sub>σ</sub>, and pronounced as [upfa],

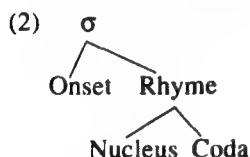
with devoicing of the /b/. Second, foreign geographical names are also subjected to this rule, resulting in pronunciations such as [sitni] for *Sidney*. Thus, these facts support the claim that the correct generalization concerning the pronunciation of obstruents can only be made in terms of syllable structure.

(c) The third role of the syllable is that it functions as the bearer of stress properties. Moreover, the location of stress in a word is dependent on the length ('quantity') of the syllables of that word. This will be dealt with in Chapter 5.

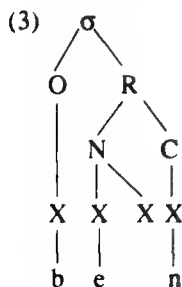
Syllables are concatenated into prosodic words, if possible. In simple cases, each word (in the morphological/syntactic sense) corresponds to one prosodic word. For instance, the word *hoed-en* 'hats' consists of two syllables that form one prosodic word. A compound like *hoedenwinkel* 'hat shop', on the other hand, consists of two prosodic words, which each form a domain of syllabification, *hoeden* and *winkel*, as will be explained in Section 3.6.

### 3.2. THE REPRESENTATION OF SYLLABLE STRUCTURE

Each syllable consists of an obligatory nucleus (either a vowel or—in some languages—a syllabic consonant), preceded by zero or more consonants (the onset), and followed by zero or more consonants (the coda). Nucleus and coda form the rhyme. In sum, the internal structure of the syllable is traditionally assumed to be as in (2).<sup>1</sup>



For instance, the syllabic representation of a word like *been* /ben/ 'leg' will be as given in (3).



<sup>1</sup> This representation of syllable structure is only used in order to present the descriptive generalizations concerning Dutch syllables as clearly as possible. No theoretical status is claimed for this particular model of syllable structure. Other models can be found in Clements and Keyser (1983) (flat syllable with only a nucleus), Levin (1985) (syllable as X-bar projection of nucleus), and in Hyman (1985), Zec (1988), and Hayes (1989) (syllables consisting of morae).

As (3) shows, syllable structure is not erected directly on the segments of the melodic tier, but on the X-tier. This is crucial for a proper account of Dutch syllable structure since long vowels, which correspond to two X-positions, are indeed to count as two positions in syllable structure. The relevant generalization is that Dutch rhymes contain at most three positions at the X-tier, that is, they contain either a short vowel and at most two consonants, or a long vowel or diphthong and at most one consonant. This restriction is illustrated in (4), with long vowels represented orthographically by a sequence of two identical letters:

(4) aam, eim, amp, \*aamp, \*eimp, \*almp, \*ermp

Since the schwa also has two X-positions (Section 2.5.4), it is correctly predicted to combine with at most one consonant in a rhyme.

### 3.3. THE SYLLABLE TEMPLATE OF DUTCH

The notion 'possible syllable of Dutch' will be defined by the following set of constraints:<sup>2</sup>

(a) The universal principle that is referred to as the Sonority Sequencing Generalization (Selkirk 1982). I will assume the following version, based on Zec (1988) and Clements (1990):

(5) Sonority Sequencing Generalization (SSG)

The sonority of consonants must decrease towards the edges of a syllable, where the sonority of consonants is defined by the following scale of decreasing sonority:

Glide–Liquid–Nasal–Obstruent



decreasing sonority

This principle restricts the co-occurrence of segments in onsets and codas, and also explains the mirror image effects in these constraints, as illustrated in (6):

(6) klem 'grip', \*lkem      melk 'milk', \*mekl  
slop 'slum', \*lsop      pols 'wrist', \*posl

(b) The parameter of syllabicity. Universally, vowels can function as nuclei, but languages differ with respect to the syllabicity of consonants. Standard Dutch only has vowels as nuclei, whereas some non-standard dialects also allow for syllabic nasals. Note that this shows that the parameter is independent from the SSG because in these dialects liquids do not function as nuclei although they rank higher in the sonority hierarchy than nasals.<sup>3</sup>

<sup>2</sup> Detailed studies of Dutch syllable structure can be found in Booij (1981a: ch. 6), Trommelen (1984), Van der Hulst (1984), and Kager (1989).

<sup>3</sup> This point is also made by Clements (1990: 294), who refers to the findings of Alan Bell in this respect.

(c) Language-specific restrictions on the number of X-positions in the different syllable constituents. As already stated above, the Dutch rhyme consists of at most three positions, and minimally two positions. The nucleus consists of at most two positions.<sup>4</sup> The Dutch onset contains at most three positions.

(d) Language-specific constraints on the possible combinations of segments. For instance, Dutch does not allow for the onset /tʃ/ although this cluster does not violate the SSG. These constraints will be discussed in detail in Section 3.5.

The SSG refers crucially to classes of segments such as glides, liquids, etc. Therefore, our system of phonological features must be able to identify them as such. Moreover, as will be shown in Section 3.5, language-specific constraints also require the availability of features that can single out classes of segments such as glides and liquids. As proposed by Clements (1990), we can identify the relevant classes, and also derive the sonority ranking required, by making use of the major class features [vocoid], [approximant], and [sonorant]. The feature [vocoid] characterizes vowels and glides, and the feature [approximant] stands for 'an articulation in which one articulator is close to another, but without the vocal tract being narrowed to such an extent that a turbulent airstream is produced' (Ladefoged 1982: 10).<sup>5</sup>

The Sonority Ranking Hierarchy can now be derived from the number of positive specifications for the major class features as shown in Table 3.1.<sup>6</sup> Nuclei consist of either one or two segments, with at least one of them linked to a [-consonant] root. The nucleus (N) may contain two (short) vowels, that is, a complex nucleus, if they form one of the three Dutch diphthongs. The template for admissible complex nuclei has already been defined in Section 2.5.3.

TABLE 3.1. *Sonority Ranking Hierarchy*

	Obstruent	< Nasal	< Liquid	< Glide
[voc]	—	—	—	+
[appr]	—	—	+	+
[son]	—	+	+	+
Sonority Ranking	0	1	2	3

In the case of nuclei containing only one short vowel, the nucleus must be followed by at least one consonant. In other words, a syllable cannot end in a short vowel. This is expressed in the Minimal Rhyme Constraint:

<sup>4</sup> This appears to be a universal tendency, cf. Kenstowicz and Rubach (1987), Booij (1989a) and the references given there.

<sup>5</sup> Cited after Clements (1990: 293).

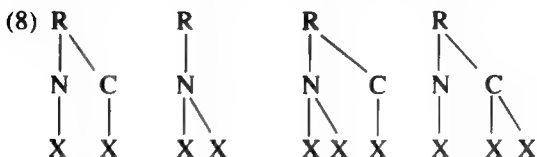
<sup>6</sup> The variant I use here is that argued for in Zec (1988: 83).



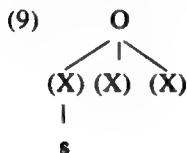
## (7) Minimal Rhyme Constraint

Dutch rhymes consist of at least two X-positions.

Hence, we find the types of Dutch rhyme (R) given in (8).



Dutch onsets (O) consist of zero to three positions. If there are three, the first one must be occupied by /s/. So the Dutch onset template is that in (9).



## 3.3.1. Appendices

It is a well-known observation on Dutch that it exhibits so-called 'edge of constituent phenomena'.<sup>7</sup> In particular, it has been observed by Moulton (1956) for German—and this also applies to Dutch—that a word can end in an extra-long sequence of consonants: after the rhyme of the last syllable that contains at most three positions, we can get up to three coronal obstruents, the so-called Appendix.<sup>8</sup> This is illustrated in (10), where the hyphen marks the boundary between coda and appendix. The examples with a schwa preceding the appendix serve to show that the schwa patterns phonotactically like long vowels (Trommelen 1984):

## (10) a. Appendix of one segment

koord /kor-d/ 'cord'

Geert /yer-t/ 'id.' (Christian name)

bofferd /bɔfər-d/ 'lucky person'

<sup>7</sup> Cf. Booij (1983), Steriade (1991) and the references cited there, and Rubach and Booij (1990b).

<sup>8</sup> There are a few exceptionally long rhymes with four positions in words like *twaaif* 'twelve' and *bruusk* 'sudden', in placenames such as *Weesp*, family names such as *Buunk* and *Rienks*, and in the past-tense forms of some strong verbs: *hield*, *hielp*, *wierp*, *bedierf*, *verwierf*, *stierf* (from respectively *houden* 'to hold', *helpen* 'to help', *werpen* 'to throw', *bederven* 'to spoil', *verwerven* 'to acquire', and *sterven* 'to die'). Other examples are words ending in -rn such as *hoorn* 'horn', *toorn* 'rage', *voorn* 'rock-bass', and *lantaarn* 'streetlamp'. There is a tendency, however, to insert a schwa before the /n/.

Exceptionally long rhymes also arise when a word ending in /ts/ is suffixed, as in *koorts-ig* 'feverish', with the syllabification pattern (koort)<sub>σ</sub>(sig)<sub>σ</sub>. It is remarkable, therefore, that Dutch has very few underived words ending in a long rhyme + /ts/. The appendix cluster /st/ does not cause this problem since /st/ is a well-formed onset, unlike /ts/.

Evert /evər-t/ 'id.' (Christian name)

kaars /kar-s/ 'candle'

Evers /evər-s/ 'id.' (family name)

laars /lar-z/ 'boot'

b. Appendix of two segments

koorts /kɔr-ts/ 'fever'

Everts /evər-ts 'id.' (family name)

ernst /ɛrn-st/ 'seriousness'

herfst /hɛrf-st/ 'autumn'

eerst /er-st/ 'first'

aardigst /ardəɣ-st/ 'nicest'

c. Appendix of three segments

bedaardst /bɛdar-dst/ 'calmest'

vermoeidst /vɛrmuj-dst/ 'most tired'

promptst /prɔmp-tst/ 'most prompt'

It should be noted that an appendix with three coronal consonants, phonetically always the sequence [tst], is hard to pronounce; usually, the first [t] is not pronounced.

We thus conclude that a well-formed prosodic word of Dutch consists of one or more syllables followed by an appendix of up to three coronal obstruents.<sup>9</sup>

The concept of 'appendix' also explains why we can combine two or more obstruents with the same degree of sonority: the SSG does not pertain to appendices.<sup>10</sup> This also applies to words like *gips* 'plaster' and *straks* 'soon'. Here, the final /s/ can be interpreted as an appendix even though the rhymes /ɪp/ and /ɔk/ do not have their maximal length.

In Section 6.2 it will be argued that consonants are prosodified as appendix consonants if possible.<sup>11</sup>

A relevant observation in this connection is that Dutch vowelless suffixes always consist of one or more coronal obstruents, which makes it possible to always attach them to a stem without violating prosodic well-formedness conditions.

Similar appendix phenomena seem to occur at the left edges of Dutch words: a Dutch onset consists of two positions, possibly preceded by /s/. The following word-initial clusters of three consonants occur:

- (11) spl-      *split* 'id.'  
       spr-      *spreeuw* 'starling'

<sup>9</sup> It may be that the limit on the number of appendix consonants need not be stated as part of the phonology of Dutch since it may be assumed to follow from the fact that longer strings of coronal obstruents are simply unpronounceable.

<sup>10</sup> This does not mean, however, that the selection of appendix consonants is completely arbitrary in terms of the SSG, since only obstruents can occur in that position.

<sup>11</sup> Hall (1992: 123), on the other hand, proposes for German that coronal obstruents are adjoined to the preceding syllable by a rule of Stray Consonant Adjunction, which implies that only those consonants are interpreted as appendices which cannot be fitted into the normal syllable template.

str-	<i>stroom</i> 'stream'
skr-	<i>skriba</i> 'scribe'
skl-	<i>sklerose</i> 'sclerosis'
sxr-	<i>schreeuw</i> 'cry'

Trommelen (1984) suggested that we should interpret the word-initial /s/ as an appendix. This would explain why only the /s/ occurs in clusters of three consonants. Moreover, the SSG violations in /sC-/ clusters would also be explained. However, as Van der Hulst (1984: 66) has pointed out, an appendix interpretation of the /s/ predicts that it freely co-occurs with all possible onsets, which is incorrect. For instance, although *tw-*, *xl-*, *fl-*, and *fr-* are correct onsets, the clusters *stw-*, *sxl-*, *sfl-*, and *sfr-* are impossible.

Another problematical aspect of the appendix interpretation of the word-initial /s/ is that it implies that sC- and sCC- clusters do not occur in word-internal syllables, which is incorrect (Booij 1984), given syllabifications such as the following:

- (12) got-spe 'chutspah'  
 En-sche-dé 'id.' (place-name)  
 ka-ta-stro-fe 'catastrophe'  
 ek-stra 'extra'  
 ven-ster 'window'

Therefore, I will assume the onset template (9) for Dutch.

The claim that coronal appendices are only allowed at the right edges of words seems to be contradicted by the following words with a seemingly word-internal appendix:

- (13) aartsbisshop 'archbishop'  
 herfstkleuren 'autumn colours'  
 koortsachtig 'feverish'

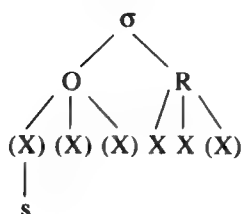
However, the relevant notion 'word' to be used here is that of 'prosodic word', not 'grammatical word'. As will be shown below, the prefix *aarts-*, the compound constituent *herfst*, and the suffix *-achtig* form independent prosodic words. Therefore, a coronal appendix can appear in such cases.

In sum, we have arrived at the templates (14) for Dutch syllables and prosodic words.

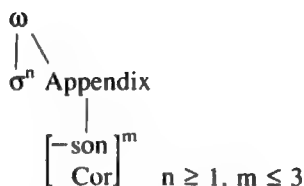
The role of the prosodic word as a domain of phonotactic constraints is not restricted to the distribution of appendices. Other conditions on prosodic words will be discussed in Section 3.6, where it is shown that a prosodic word cannot begin with a schwa, and that it has to contain at least one syllable with a full vowel.

Furthermore, Dutch does not allow for geminate consonants within prosodic words, unlike languages such as Finnish, Icelandic, and Italian. In other words, although, for example, the syllables /bak/ and /kar/ are both well-formed, they cannot be combined into the prosodic word /bakkar/. If a sequence of identical

(14) a. Syllable:



b. Prosodic word



consonants arises within a prosodic word due to some morphological operation, as in *grootte* /ɣrot+tə/ 'size', an obligatory rule of Degemination applies, resulting in this case in the phonetic form [ɣrotə]. Since there is a phonological rule (P-rule) expressing this constraint, the prohibition on geminates need not be part of the prosodic word template. This shows that the phonotactic constraints on the possible words of a language are not expressed by just one type of constraint: these constraints are defined by an array of different types of rules: syllable-structure conditions, prosodic word conditions, sequential constraints (Section 3.5.5), and phonological rules (P-rules, Section 4.2).<sup>12</sup> Together, they define the notion 'possible prosodic word of language L'.

### 3.4. SYLLABIFICATION

The syllabification of Dutch words is predictable on the basis of the syllable template given above (14a). Before syllabifying a word, we will have to determine the domains of syllabification.

#### 3.4.1. The domains of syllabification

In Section 3.3.1 I pointed out that we have to distinguish between the grammatical word and the prosodic word, and that the appendix appears on the right periphery of prosodic words. Crucially, a prosodic word does not always correspond to a grammatical word. This also explains why in a compound such as *handappel* '(lit.) hand apple', 'eating apple' with the morphological structure  $[[hand]_N[appel]_N]_N$ , the final /d/ of *hand* is not syllabified with the /a/

<sup>12</sup> The point that phonetic constraints are the effects of both static constraints and phonological rules is made in Postal (1968). Morpholexical rules, i.e. phonological rules conditioned by morphological or diacritic properties, do not form part of the definition of 'possible prosodic word of a language'.

of *appel* in conformity with the universal principle that a consonant is syllabified with a following adjacent vowel: *hand* and *appel* form two different domains of prosodification, and hence each corresponds with a prosodic word because the syllables in a domain of syllabification form one prosodic word.<sup>13</sup>

The following mapping rules define the relation between morphological structure and syllabification domains for Dutch (Booij 1977, 1981a, 1985a):

- (15) a. In compounds, each constituent that can form a grammatical word of its own is an independent domain of syllabification. (For instance, in *handappel* the two constituents *hand* and *appel* are syllabified separately, and hence the /d/ of *hand* devoices: [hantapəl].)
- b. Prefixes form independent domains of syllabification, as is clear from the syllabification of prefixed words: there is always a syllable boundary coinciding with the prefix boundary (for instance *ontaard* 'degenerate' with the syllabification pattern (ɔnt)σ(ard)σ).<sup>14</sup>
- c. Most suffixes do not form an independent domain of syllabification, but form a prosodic word with the preceding material, as illustrated in Section 3.1. There are, however, a number of suffixes with at least one full vowel, such as *-achtig* '-ish', *-baar* '-able', *-dom* 'the set of', *-heid* '-ness', *-ling* '-ling', *-loos* '-less', *-schap* '-ship', and *-zaam* 'inclined to', that do form independent domains of syllabification, and thus form prosodic words of their own. They are all consonant-initial except for *-achtig*.

The fact that word-internal compound boundaries and prefix boundaries always form edges of a syllabification domain seems to be a universal tendency (Rubach and Booij 1990b). It can be expressed as follows:

'Lexical syllabification does not apply across [  
(where '[' is a left morphological bracket).

### 3.4.2. Maximal Onset and Minimal Rhyme

Syllabification can be seen as the matching of the syllable template of a language with the segmental string of a word in such a way that a maximal number of segments is syllabified into a minimal number of syllables (Itô 1989). Furthermore, syllabification is subject to the universal principle that a consonant before a syllabic segment always forms a syllable with that syllabic segment, the universal CV-rule.

Syllable template matching can in principle take place from left to right or from right to left. If it takes place from right to left, the result is that, in a

<sup>13</sup> As pointed out in Booij (1988b), we cannot assume that the prosodic word itself is the domain of syllabification since this would lead to a paradox: the prosodic word presupposes the presence of syllables.

<sup>14</sup> This does not necessarily imply that prefixes are always prosodic words of their own, as will be shown in Section 3.6.

sequence of consonants between two syllabic segments, as many consonants as possible are assigned to the onset. In other words, right-to-left syllabification gives us the Maximal Onset effect. Dutch, like many other Indo-European languages, appears to require maximal onsets.<sup>15</sup>

If we conceive of the prosodic word template as comprising the syllable template, as proposed in (14*b*), the prosodic word template also has to be matched from right to left. This correctly implies that word-final coronal obstruents will be matched with the Appendix position, even if they could also have filled a rhyme position, as in *gans* 'goose' (cf. Section 6.2).

A Dutch rhyme consists of at least two X-positions, the Minimal Rhyme Constraint. This correctly predicts that word-final syllables cannot end in a short vowel. (Exceptions are some exclamations such as *hè* [hɛ], *joh* [jɔ], *bah* [ba], and *goh* [ɣɔ], and French loan-words such as *cachet* [kafʃɛ] 'id.' and *bidet* [bidɛ] 'id.'). On the other hand, word-internal rhymes ending in a short vowel seem to be admissible:

(16) *adder* [ʌdər] 'snake', *letter* [lɛtər] 'id.', *opper* [ɔpər] 'upper'

Nevertheless, I will assume, with Van der Hulst (1984) and Kager (1989), that the Minimal Rhyme Constraint applies word-internally. This explains why we do not find words with a word-internal short vowel followed immediately by another vowel, for instance /hiat/ (compare /hiat/ 'hiatus'): after a short vowel a consonant is required in order to get a minimal rhyme.

The question now is how the universal CV-rule and the Minimal Rhyme Constraint can be reconciled in the syllabification of a word like *adder* [ʌdər] 'snake'. The Maximal Onset effect of right-to-left syllabification will of course be overruled by the absolute Minimal Rhyme Constraint<sup>16</sup> as the following examples show (the hyphen indicates the relevant syllabification):

(17) *as-ter* 'id.'  
*as-pect* 'id.'  
*vis-[k]ose* 'viscose'  
*Pas-[x]a* 'Pesach'  
*a[k]-ne* 'acne'

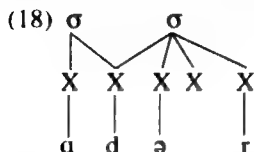
Note that although *st-*, *sp-*, *sk-*, *sx-*, and *kn-* are possible onsets of Dutch, these clusters are nevertheless heterosyllabic in these words, in order to comply with the Minimal Rhyme requirement.<sup>17</sup>

<sup>15</sup> Instead of assuming directionality of syllabification, the Maximal Onset effect may also be derived from the requirement that syllable contacts are optimal (cf. Clements 1990) which implies that, for instance, *bl-* is better than *b-/* since in the latter case we get a bad syllable contact: obstruent before sonorant, whereas in an optimal syllable contact the more sonorous consonant comes first.

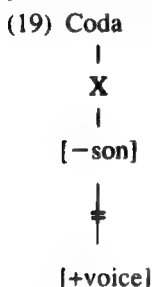
<sup>16</sup> The priority of language-specific minimal rhyme constraints in matching syllable templates with strings is also argued for Archangeli (1991).

<sup>17</sup> Intuitions as to the syllabification of intervocalic /s/ appear to vary, as shown in Rietveld (1983). It may be that at the surface level the /s/ in, e.g. *aster* is also ambisyllabic. Evidence other than intuitions on syllabification seems to be lacking here.

The only way in which a word like *adder* can be syllabified without violating the universal CV-rule and the Dutch Minimal Rhyme Constraint is by assigning the intervocalic /d/ to both syllables. In other words, the /d/ is ambisyllabic (see (18)).<sup>18</sup>



The ambisyllabicity of the /d/ will block its devoicing in syllable-final position. To see this, rule (1) should be reformulated as delinking rule (19).



After delinking, the consonant no longer bears the feature [+voice], and hence it will be realized as a voiceless consonant.

Note that the /d/ of *adder* does not satisfy the structural description of this rule, because the /d/ is also linked to the onset of a second  $\sigma$ . The required blocking of the application of the devoicing rule can be achieved by the so-called Uniform Applicability Condition (UAC) from Schein and Steriade (1986: 727):

(20) Uniform Applicability Condition (UAC)

Given a node  $n$ , a set  $S$  consisting of all nodes linked to  $n$  on some tier  $T$ , and a rule  $R$  that alters the content of  $n$ : a condition in the structural description of  $R$  on any member of  $S$  is a condition on every member of  $S$ .

The relevant node is [-sonorant] which does not lose [+voice] when it is ambisyllabic because in that case one of the nodes to which the X-slot is linked, is not a coda, as required by the rule.<sup>19</sup>

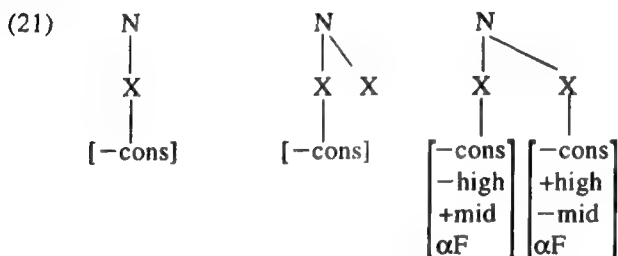
This description of final devoicing, however, does not account for the fact that final devoicing also applies to voiced obstruents in Appendix positions, such as the /z/ of *laars* /laarz/ 'boot' that is pronounced as [s]. Lombardi

<sup>18</sup> When the internal structure of the syllable is irrelevant, it will not be represented.

<sup>19</sup> Note that in this case the Linking Constraint proposed by Hayes (1986): 'Association lines in structural descriptions are interpreted as exhaustive', also makes the correct prediction, as is pointed out by Van der Hulst (1985). However, as we will see in Chapter 4, the Linking Constraint also incorrectly blocks the application of Final Devoicing to voiced obstruent clusters—which share the feature [+voice]—in coda position.

(1991) therefore proposed to assign a different interpretation to final devoicing: the (in her theory, privative) feature [voice] is only licensed in Dutch onsets. Therefore, it must (by convention) be delinked from any other position. This results in final devoicing of obstruents in both Coda and Appendix positions. The condition that [voice] is only licensed in onsets should be taken to apply at a particular level of phonological derivation: not at the underlying level, but at the word level (cf. Chapter 4). In this analysis, we do not have to invoke the UAC to explain why the /d/ of *adder* is not devoiced: its feature [voice] is licensed by its being linked to the onset of the second syllable.

The nucleus of Dutch syllables contains either one or two X-positions, and the first has to be linked to [-consonant]. Thus we get the possible nuclei in (21).



short vowels      long vowels      diphthongs

Given this set of possible nuclei, the glide [j] which is a short /i/ in underlying forms will always be assigned to an onset or a coda position, as required, except when it is preceded by the /ε/ in which case it will be interpreted as the second part of a diphthong. For instance, in the word *aai* /ai/ 'to caress' it is impossible to interpret the vocoid sequence as a complex nucleus. Hence, the only possible solution is to assign /i/ to the coda. Similarly, the postvocalic vocoid /u/ will automatically be interpreted as a glide when the syllable template is matched with the phonological string of a word, as in *nieuw* /niuv/ 'new'.

### 3.5. CO-OCCURRENCE CONSTRAINTS

#### 3.5.1. Rhyme constraints

As stated above, Dutch rhymes consist of at most three positions. Trommelen (1984: 121) observed that word-internal three-positional rhymes tend to end in an obstruent rather than a sonorant consonant.<sup>20</sup> This restriction accounts for

<sup>20</sup> Kager and Zonneveld (1986) proposed the even stronger constraint that word-internal rhymes of simplex words consist of at most two positions. As Kager (1989: 205–7) points out, there is a substantial number of exceptions/counterexamples to this constraint.



the opposition between the unacceptable words in (22a) and the existing words in (22b,c):

- |                  |                       |                        |
|------------------|-----------------------|------------------------|
| (22) a. *teem-po | b. tem-po 'id.'       | c. bauk-siet 'bauxite' |
| *oom-nibus       | om-nibus 'id.'        | buus-te 'bust'         |
| *term-po         | tem-po 'id.'          | kloos-ter 'cloister'   |
| *marn-darijn     | man-darijn 'mandarin' | hyp-nose 'hypnosis'    |

However, as pointed out by Booij (1984) and Kager (1989), this rhyme constraint has quite a number of exceptions, some of which are listed here:

- (23) aal-moes 'alms', pien-ter 'smart', Maar-ten 'id.' (proper name), aar-de 'earth', vaan-del 'banner'

Moreover, the constraint does not hold for morphologically complex words:

- |  |                                  |
|--|----------------------------------|
| (24) <i>Plural nouns with the suffix -en</i> | <i>Past-tense forms of verbs</i> |
| maan-den 'months'                            | talm-de 'hesitated'              |
| beem-den 'meadows'                           | kerm-de 'moaned'                 |
| baar-den 'beards'                            |                                  |
| naal-den 'needles'                           |                                  |

Conceptually, it is not attractive to propose syllable templates that only hold for simplex words. It is a basic insight that words are structured in two ways, in terms of a morphological and a prosodic hierarchy, which need not be isomorphic. Therefore, I interpret Trommelen's observation as a (prosodic) Morpheme Structure Condition (cf. Section 3.5.5): morpheme-internal syllables with three-positional rhymes tend to end in an obstruent consonant.

Within rhymes, diphthongs cannot be followed by a glide or by /r/: sequences such as /ɛiʊ/, /œyʊ/, /ɔuj/, and /ɛir/ are ill-formed.<sup>21</sup> /ɛir/, /œyr/ and /ɔur/ are only pronounceable by inserting a schwa before the /r/. This constraint may be explained in terms of co-articulation: the phonetic realization of a diphthong requires a movement of the tongue in the direction of the position of the high vowels, whereas the /r/ has a centralizing effect, and requires a movement of the tongue into the direction of the centre of the vowel space (cf. Koopmans-van Beinum 1969).

This constraint also shows the importance of the syllable and its constituents as domains of phonotactic restrictions since the Dutch diphthongs do occur before a heterosyllabic /r/, as in *Beira* [beira] 'id.' (place-name), *neuron* [nœyrɔn] 'id.', and *Laura* [lɔura] 'id.'.

<sup>21</sup> An exception is the loan-word *reveil* /rævi:j/ 'revival'.

In Dutch orthography we find spellings like *ouw* and *auw* in words such as *jouw* 'your' and *rauw* 'raw', suggesting that in these words a /ʊ/ follows the back diphthong. However, these letter sequences should be taken as standing for just the back diphthong. This is also proven by the quite frequent spelling mistake of using *jou*, which is the correct spelling for the personal pronoun, 2 sg. 'you', as the spelling for the possessive pronoun 2 sg. 'your', which is phonetically undistinguishable from the 2 sg. personal pronoun. Similar pairs of homophones which are distinguished in the spelling are *hou* 'hold' (1 sg. pres.) vs. *houw* 'hew' (1 sg. pres.), *kou* 'cold' vs. *kauw* 'chew' (1 sg. pres.), and *nou* 'now' vs. *nauw* 'narrow'.

## (25) Diphthong-r Constraint

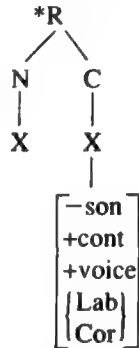
$$*([ -\text{cons} ][ -\text{cons} ] \begin{bmatrix} +\text{cons} \\ +\text{appr} \\ +\text{cont} \end{bmatrix})_{\text{RHYME}}$$

The next constraint to be discussed is that short vowels cannot be followed by /v/ or /z/, except in the loan-words *razzia* [rəzija] 'raid', *puzzel* [pyzəl] 'puzzle', and *mazzel* [məzəl] 'good luck'. This restriction is illustrated in (26):

- (26) a. kaas /kaz/ 'cheese', kazen /kazən/ 'cheeses', Pasen /pasən/ 'Easter',  
 passen /pasən/ 'to fit'; but \*/kaz/, \*/pazən/  
 b. graaf /ɣraf/ 'graph', grafen /ɣrafən/ 'graphs', graaf /ɣrav/ 'earl',  
 graven /ɣravən/ 'earls', maf /maf/ 'mad', maffe /mafə/ 'mad',  
 (inflected form); but: \*/mav/, \*/mavə/

We therefore have to assume the constraint (27):

## (27) /v/-/z/ Constraint



The /v/-/z/ Constraint explains why native speakers of Dutch are inclined to pronounce *puzzel* as [pyzəl], with a long vowel before the /z/. It can be formulated as a rhyme constraint because it concerns short vowels, which always require a following tautosyllabic consonant.<sup>22</sup> In other words, it will also exclude the sequence short vowel + /v/ or /z/ + vowel in polysyllabic words.

Another rhyme constraint is that the /ŋ/ cannot be preceded by long vowels or diphthongs: *-eng*, *\*-eeng*, *\*-eing*. It will be discussed in Section 3.5.5 because it can also be interpreted as a sequential constraint.

## 3.5.2. Onset Constraints

All Dutch consonants except the velar nasal can appear in syllable-initial position.<sup>23</sup> This is expressed by constraint (28).

<sup>22</sup> In Kager (1989: 196) it is indeed analysed as a rhyme constraint.

<sup>23</sup> Kager (1989) suggested that this follows from assuming the underlying representation /Ng/ for velar nasals, in combination with the SSG. However, both Booij (1980) and Trommelen (1983) have argued that this analysis is untenable.

- (28) Velar Nasal Constraint    \*O  
    |  
    X  
    |  
    [ +nas  
    Dors ]

Interestingly, the velar nasal does occur in word-internal onsets after a short vowel as in *engel* [ɛŋəl] 'angel'. Here, the velar nasal is ambisyllabic:

- (29)
- 

Therefore, the Uniform Applicability Condition will prohibit the Velar Nasal Constraint from applying.<sup>24</sup> After long vowels, a word-internal /ŋ/ would be syllabified as an onset because of the constraint on velar nasals mentioned in the preceding section, but this will be excluded by the onset constraint (28). Hence, we do not find words like *zaanger* /zaŋər/.

Let us now turn to CC-constraints. To begin with, the /h/ does not combine with other consonants in onsets:

- (30) /h/-onset Constraint

A branching onset may not dominate [+aspirated].

A more general condition is that an onset never contains two sonorant consonants: combinations of nasals with liquids or glides, or liquids with glides are excluded:

- (31) Branching-onset Constraint

A branching onset must dominate [–sonorant].

Obstruents combine with glides, liquids, and nasals. A survey of possible clusters is given in (32):

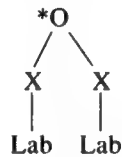
- (32)
- |     |                                |
|-----|--------------------------------|
| pj- | riempje 'little belt'          |
| tj- | traantje 'little tear'         |
| kj- | koninkje 'little king'         |
| dj- | adieu 'farewell' (loan-word)   |
| tw- | twee 'two'                     |
| dw- | dwaas 'stupid'                 |
| sw- | swingen 'to swing' (loan-word) |
| zw- | zweet 'sweat'                  |
| fj- | fjord 'id.' (loan-word)        |

<sup>24</sup> Alternatively, one might say in the framework of Goldsmith (1990) and Lombardi (1991) that velar nasals are only licensed in codas. The velar nasal in the onset of the second syllable of *engel* is then 'parasitically licensed', through its link with the coda of the previous syllable.

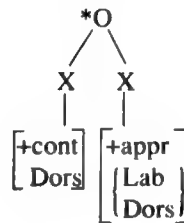
- sj-        *sjaal* 'shawl' (loan-word)  
 zj-        *jury* 'id.' (loan-word)

I will exclude /dj-/ and /zj-/ as possible onsets because they only occur in loan-words, and because word-internally they do not form onsets in non-borrowed words such as diminutives. For instance, the word *handje* /handjə/ 'hand', (dimin.) is syllabified as (hund)<sub>σ</sub>(jə)<sub>σ</sub> as shown by the fact that syllable-final devoicing applies: [hʌntjə]. Therefore, the onset constraints (33) will be assumed.

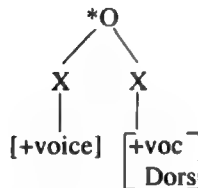
- (33) a. \*bw-, \*pw-, \*vw-, \*fw-



- b. \*xj-, \*ɣj-, \*xw-, \*ɣw-



- c. \*bj-, \*dj-, \*vj-, \*zj-



Constraint (33a) also excludes labial obstruents before /m/, a correct prediction.

The first three clusters of (32) also illustrate that the set of possible word-initial clusters need not be identical to the set of syllable-initial clusters (cf. Booij 1983): *pj-*, *tj-*, and *kj-* do not occur as word-initial clusters except in loan-words. In other words, the prosodic word is also a domain of phonotactic restrictions, as already proven by the appendix phenomena.

Obstruent plus liquids combine rather easily, as the following survey shows:

- (34) Obstruents + liquids

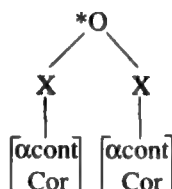
- pl-        *plant* 'id.'  
 bl-        *bloem* 'flower'  
 pr-        *pruim* 'plum'  
 br-        *bruin* 'brown'  
 tr-        *trein* 'train'

dr-	<i>droog</i> 'dry'
fl-	<i>fles</i> 'bottle'
vl-	<i>vlas</i> 'flax'
fr-	<i>fraai</i> 'beautiful'
vr-	<i>vriend</i> 'friend'
sl-	<i>slank</i> 'slim'
xl-	<i>chloor</i> 'chlorine'
xr-	<i>chroom</i> 'chrome'
yl-	<i>glas</i> 'glass'
yr-	<i>gras</i> 'grass'

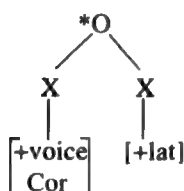
Thus, the following clusters are out: *tl-*, *dl-*, *zl-*, *zr-*, and *sr-*. This is formulated in the constraints (35).

(35) Obstruent + Liquid Constraints

a. \**tl-*, \**dl-*, \**sr-*, \**zr-*



b. \**zl-*



A remarkable onset type is the combination /*vr-*/ that occurs in a few words such as *wreed* 'cruel' and *wrijven* 'to rub'. This sequence is an exception to the SSG since the /*v*/ is a non-vocoid approximant here, with the same degree of sonority as the /*r*/ . This explains that many speakers of Dutch actually pronounce the *w* as [v] rather than as [ʋ], i.e., as a fricative obstruent, thus avoiding violation of the SSG.

Finally, we have to consider obstruent + nasal clusters. Generally, they do not combine, with the exception of the clusters listed here:<sup>25</sup>

(36) Obstruent + Nasal

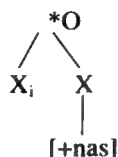
sm-	<i>smaak</i> 'taste'
sn-	<i>snee</i> 'cut'
kn-	<i>knie</i> 'knee'

Other combinations occur, but only in a few exceptional words (partially loan-words), namely *pn-*, as in *pneumatisch* 'pneumatic', *fn-* as in *fnuiken* 'to

<sup>25</sup> There is a universal tendency in languages that onset clusters of obstruents plus nasals are very marked, whereas obstruents combine easily with glides and liquids (cf. Broselow (1991) ).

cripple', and *gn-* as in *gnuiven* 'to gloat'. The ill-formed clusters and the rare onsets *pn-*, *fn-*, and *gn-* are excluded by constraint (37).

(37) Obstruent + Nasal Constraint



Condition:

$X_i \neq [+cont, -voice, Cor]$  or  $[-cont, Dors]$

Combinations of stops and fricatives are excluded by the SSG that ranks them as of equal sonority. Such combinations do occur, however, in some loan-words like *psalm* 'id.', *tsaar* 'tsar', and *Xantippe* 'id.' (the letter X stands for [ks]).<sup>26</sup> Moreover, the /s/ occupies a special position in that it combines with both stops and fricatives:

- (38) *sp-* *spin* 'spider'  
*st-* *steen* 'stone'  
*sk-* *skelet* 'skeleton'  
*sf-* *sfeer* 'sphere'  
*sx-* *school* 'id.'

We might try to explain this exceptional behaviour by assuming that /s/ is a word-initial appendix. However, it was argued in Section 3.3.1 that this solution cannot be upheld. So the generalization seems to be the following:<sup>27</sup>

(39) In sC(C)-clusters, the sequence sC may violate the SSG.

As noted in Section 3.3.1, there is only a very restricted set of CCC clusters:<sup>28</sup>

- (40) *spr-* *spreeuw* 'starling'  
*str-* *stroom* 'stream'  
*skr-* *skriba* 'scribe'  
*spl-* *splinter* 'id.'  
*skl-* *sklerose* 'sclerosis'  
*sxr-* *schreeuw* 'cry'

Thus, the following descriptive generalization can be made:

(41) In CCC onset clusters the final CC is either a possible Stop + Liquid cluster, or a velar fricative + /r/

This will exclude sequences such as /stl-/ because /tl-/ is ill-formed, but also sequences like /sfl-/ and /sfr-/.

<sup>26</sup> This implies that other languages may make a difference in sonority between stops and fricatives.

<sup>27</sup> The special nature of the combination /s/ plus stop in that it behaves as a unit, a sort of complex segment, appears to be a cross-linguistic universal, as has frequently been noted in the literature (cf. Ewen 1982, Selkirk 1982, Steriade 1982, Broselow 1991).

<sup>28</sup> In loan-words we also find /stj-/ and /skw-/ as in *steward* 'id.' and *squadron* 'id.' respectively.

## 3.5.3. Coda constraints

The only consonant that never occurs in codas is the /h/, as expressed in (42).

- (42) /h/-coda Constraint
- $$\begin{array}{c}
 *C \\
 | \\
 X \\
 | \\
 [+asp]
 \end{array}$$

This can be related to the fact that the /h/ needs to be followed by a vowel in order to receive a specification for its Place features: it is parasitic on a next vowel.

Since glides only occur after long vowels, they do not combine with other consonants in codas because otherwise the rhyme would contain more than three positions, and thus they can only be followed by coronal obstruents, the appendix consonants.

Of the logically possible liquid + nasal clusters, only /-lm, -rm, -rn/ occur:

- (43)
- |     |                        |
|-----|------------------------|
| -lm | <i>helm</i> 'helmet'   |
| -rm | <i>arm</i> 'id.'       |
| -rn | <i>karn</i> 'to churn' |

That is, we have to exclude /-ln/ and liquid + velar nasal clusters (before the velar nasal no coda consonant whatsoever can appear). This is expressed in (44).

- (44) Liquid + Nasal Constraints
- $$\begin{array}{cc}
 \begin{array}{c} *C \\ \diagup \quad \diagdown \\ X \quad X \\ | \quad | \\ [lat] \quad \begin{bmatrix} +nas \\ Cor \end{bmatrix} \end{array} & 
 \begin{array}{c} *C \\ \diagup \quad \diagdown \\ X \quad X \\ \quad | \\ \quad \begin{bmatrix} +nas \\ Dors \end{bmatrix} \end{array}
 \end{array}$$

The occurrence of clusters of liquids and obstruents is almost unrestricted, as the following survey shows:

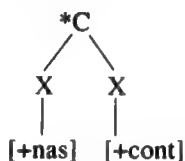
- (45)
- |     |                             |
|-----|-----------------------------|
| -lp | <i>help</i> 'id.'           |
| -lb | —                           |
| -lf | <i>elf</i> /ɛlf/ 'id.'      |
| -lv | <i>elf</i> /ɛlv/ 'eleven'   |
| -lk | <i>melk</i> 'milk'          |
| -ly | <i>alg</i> 'alga'           |
| -lx | —                           |
| -rp | <i>harp</i> 'id.'           |
| -rb | —                           |
| -rf | <i>amorf</i> 'amorphous'    |
| -rv | <i>korf</i> /kɔrv/ 'basket' |
| -rk | <i>kerk</i> /kɛrk/ 'church' |
| -rx | <i>monarch</i> 'id.'        |
| -ry | <i>erg</i> 'very'           |

There are no examples of /-lb/ and /-rb/: liquids apparently do not cluster with a /b/. The non-occurrence of /-lx/ at the underlying level is very probably an accidental gap since phonetically [lx] does occur. Of course, /-lb/ and /-rb/ would never surface as such in codas because of final devoicing.

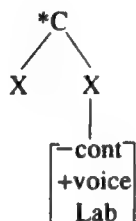
Liquids can also be followed by a coronal obstruent, but since these obstruents can also be interpreted as appendices, these clusters cannot be used as evidence for coda constraints: *held* /held/ 'hero', *milt* /milt/ 'spleen', *hard* /hard/ 'id.', *hart* /hart/ 'heart', *hals* /holz/ 'neck', *als* /als/ 'if', *hars* /hars/ 'resin', *vers* /verz/ 'verse'.

Nasal consonants cluster with stops, but not with fricatives; the nasal is always homorganic with the following plosive. Only in heterosyllabic clusters do we find clusters of nasals with fricatives (e.g. *kamfer* /kɑmfər/ 'camphor' and *angina* /ɑŋɣina/ 'id.') and with heterorganic stops (e.g. *imker* /imkər/ 'bee keeper'), which once more stresses the relevance of the syllable as a domain of phonotactics. Like the liquids, nasals do not combine with /b/. Thus we have the constraints (46) and (47).

(46) Nasal + Fricative Constraint



(47) /b/-coda Constraint



The SSG predicts that clusters of fricatives and stops do not occur, except in the Appendix. However, we do find /-sp, -st, -sk/:

- (48) -sp    *wesp* 'wasp', *gesp* 'buckle', *rasp* 'grater'  
 -st    *ast-ma* 'asthma', *ist-mus* 'isthmus'  
 -sk    *grotesk* 'grotesque', *obelisk* 'id.'

We have to allow for /-st/ as a possible coda because we cannot interpret the word-internal cluster /-st/ as in *astma* as an appendix. The clusters /-sp/ and /-sk/ also behave as real coda clusters, not as appendices, in that they cannot be preceded by a long vowel or diphthong.<sup>29</sup> Note also that they cannot be interpreted as complex segments (two melodic elements linked to one X) because distributionally they count as two X-positions. So we have to allow

<sup>29</sup> The only exceptions are a few geographical names such as *Weesp*, and the word *bruusk* 'brusque', a loan from French.



for the /s/ to violate the SSG both in onset and coda; in the coda the violations are more restricted, however, since only stops combine with the /s/.<sup>30</sup>

### 3.5.4. Pansyllabic constraints

Pansyllabic constraints are constraints governing sequences that do not fall within onset, coda, or rhyme constituents (Cairns 1988: 229), and which tend to limit recurrences of the same or similar segments within a syllable.

As Janson (1986: 192) observed, in many languages the /j/ does not occur before /i/; this is also the case for Dutch as expressed by (49).

- (49) /ji/-Constraint
- $$\begin{array}{c}
 *O \\
 | \\
 X \\
 | \\
 ( \dots [+voc]_i \quad [+voc]_i \dots )_{\sigma}
 \end{array}$$

Note that the sequence /vu/ is permitted in Dutch, because in prevocalic position the /v/ is a non-vocoid.

Another constraint on CV-sequences is that /h/ does not occur before schwa. This may have to do with the fact that /h/ lacks a supralaryngeal specification, and the schwa, being the default vowel, also lacks a supralaryngeal specification. In other words, a syllable /hə/ would have no specification of Place whatsoever. That is, the following constraint:

- (50) /hə/-Constraint
- $$* ( \dots [+asp] \quad [-cons]_u \dots )_{\sigma}$$

can be related to the following general constraint:<sup>31</sup>

- (51) Place Constraint
- A  $\sigma$  must dominate Place.

This constraint correctly predicts that there are no syllables that consist of a schwa only. However, the /hə/-Constraint is more specific since, for instance, /hət/ is impossible even though /ət/ is a possible syllable.

Another type of pansyllabic constraint in Dutch concerns the co-occurrence of two liquids in a syllable: the sequence /lVl/ is strange with long vowels, and the sequence /rVr/ is out when the vowel is short:<sup>32</sup>

<sup>30</sup> In Van der Hulst (1984) some of the constraints on consonant clusters in onsets and codas are formulated in terms of minimal sonority distance requirements on adjacent consonants. Zec (1988) argues that co-occurrence constraints such as those formulated here should be preferred to the minimal sonority distance approach.

<sup>31</sup> This was suggested to me by Carlos Gussenhoven.

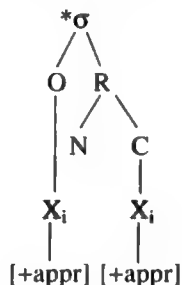
<sup>32</sup> One might wonder whether the constraint holds across syllable boundaries. If that were true, the constraint would be a morpheme structure constraint rather than a syllable structure constraint. However, we do find words like *Lola* 'id.' (Christian name) and *rara* 'guess what?' which suggest that it is a syllable structure constraint after all.

- (52) IV1 a. lol /lɔl/ 'fun', lel /lɛl/ 'lobe', lal /lal/ 'to jabber', lul /lʏl/ 'penis'  
           \*lool /lol/, \*leel /lel/, \*laal /lal/, \*luul /lʏl/, \*loel /lul/, \*liel /lil/  
       b. raar /rar/ 'strange', roer /rur/ 'rudder', Ruurd /ryrt/ 'id.' (proper name)  
           \*ror /rɔr/, \*rer /rɛr/, \*rar /rar/, \*rur /ryr/<sup>33</sup>

A similar constraint is found for glides: we never find two /j/s or two /v/s in one syllable: \*joej, \*jooj, \*jaaj, \*wiew, \*wuuw, with as exception *weeuw* /vev/ 'widow'. Since glides only occur after long vowels, the length contrast which played a role with respect to /r/ and /l/ is not relevant here.

The constraint can be expressed as in (53).

- (53) Double Approximant Constraint



Conditions:

If  $X_i$  is [+lat], N is branching

If  $X_i$  is [+cont, Cor], N is non-branching

### 3.5.5. Sequential constraints

As has been amply demonstrated above, many phonotactic restrictions should or can be seen as restrictions on possible syllables. In standard linear generative phonology, in which the notion 'syllable' did not play a role, phonotactic restrictions were expressed as morpheme structure conditions (MSCs), whereas Hooper (1972) argued that all MSCs could be replaced with syllable structure conditions (SSCs). Hooper's position is clearly too strong since languages also exhibit restrictions on combinations of segments within morphemes that are valid whether these segments belong to the same syllable or not (McCarthy 1986, Davis 1991).

A possible example of an MSC is the restriction that velar nasals in Dutch can only be followed by the schwa, as observed by Kager and Zonneveld (1986): sequences like /aŋəl/ are ill-formed in contrast to /aŋəəl/. This is expressed by the following negative constraint:

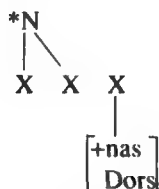
- (54) \*    [+nas]    [-cons]  
           |            |  
           Dors        Place

<sup>33</sup> There happened to be a Dutch TV programme with the name *Rur*, but this word is indeed experienced as an intentional coining.

However, such a cross-syllabic constraint can also be seen as a constraint on the possible prosodic words of Dutch.

Dutch prosodic words are also subject to the constraint that the velar nasal does not occur after a long vowel; this constraint is expressed in (55).

(55) Velar Nasal Constraint



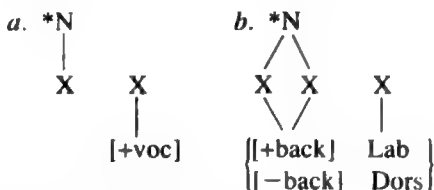
The glides /j/ and /v/ do not combine with all vowels: the /j/ only occurs after long back vowels, and the /v/ only after long front vowels:

(56) a. roei /ruj/ 'row', mooi /moj/ 'beautiful', saai /saj/ 'dull'

b. nieuw /niuv/ 'new', uw /yuv/ 'your', leeuw /lev/ 'lion'

The constraints (57) exclude the non-occurring combinations:

(57) Glide constraints



Constraint (57a) excludes glides after short vowels. The only exceptions are loan-words such as *mais* /majs/ 'maize', *boiler* /bɔjlər/ 'id.', and *detail* /detaj/ 'id.', and the word *hei* /hɔj/ 'hello'. Constraint (57b) expresses that /j/ occurs after back vowels, and /v/ after front vowels. An additional constraint is that after /ø/ we do not find glides at all.

Glide constraint (57a) also shows that Dutch diphthongs should be analysed as complex nuclei rather than as sequences of a vowel and a consonantal glide, since otherwise we cannot explain the difference in status between, for instance, /ɛi/ and /ɔi/. It also explains why after real diphthongs (i.e., complex nuclei) all kinds of consonants can appear in the coda. For instance, we find *eik*, *eip*, and *eil*, whereas *\*aik*, *\*aip*, and *\*aim* are impossible (cf. Booij 1989a). These sequential constraints are not confined to the syllable, but they do not necessarily have the morpheme as their domain: it can also be the prosodic word.

There are also constraints on clusters of consonants independent from the tautosyllabic or heterosyllabic status of these clusters. One generalization, proposed for English by Yip (1991) also appears to hold for Dutch:

(58) Consonant Cluster Condition

In consonant clusters, consonants may have at most one other articulator feature than Coronal.

For instance, Dutch allows for clusters of a non-coronal obstruent plus a coronal one:

- (59) pt     *helikopter* 'helicopter'  
       ft     *refter* 'dining-room'  
       kt     *akte* 'act'  
       xt     *echter* 'however'

However, combinations of a dorsal consonant with a labial consonant are either excluded or extremely rare:

- (60) Excluded clusters: km, mk, xm, mx, pk, kp, fk, xf, fx, kf, xp, px<sup>34</sup>

Moreover, in clusters with one coronal obstruent, the coronal is preferably the second consonant: /pt/ rather than /tp/, and /kt/ rather than /tk/. This seems to be a universal tendency (Clements 1990: 313). Again, the constraint can also be seen as a constraint on prosodic words since such clusters do not arise through morpheme concatenation: the only cohering suffix that begins with a non-coronal consonant is the allomorph *-pje* of the diminutive suffix, but this morpheme only appears after a stem ending in /m/.

The examples of obstruent clusters given here all concern voiceless obstruents. This is no coincidence: as observed by Zonneveld (1983) one hardly finds any cluster of voiced obstruents within morphemes. Those that do occur are mainly found in loan-words, such as *labda* [labda] 'lambda' and *budget* [bydʒjet] 'budget'. This suggests a negative MSC that forbids double-linked [+voice] in the lexical representations of morphemes:

- (61) \*  $\begin{matrix} X & X \\ & \diagdown \diagup \\ & [+voice] \end{matrix}$

This constraint will only apply to obstruents if other segments have no specification for [voice] at the lexical level. In this case, its status as MSC is certain since we do find clusters of voiced obstruents within prosodic words, for instance in the past-tense forms of verbs with stems ending in a voiced obstruent, for example, *tob-de* [tɔbdə] 'toiled' (sg.).

Consonant clusters are also subject to another tendency, the Syllable Contact Law, which says that in an optimal heterosyllabic consonant cluster the first consonant is more sonorous than the second one. In other words, liquids and nasals should precede obstruents in optimal syllable contacts. For instance, /mp/ is preferred to /pm/, and /nt/ to /tn/ (Clements 1990). It is indeed a correct generalization about Dutch that the first C in a heterosyllabic CC is a liquid or nasal, and the second one an obstruent. It is not an absolute restriction on pronounceability, though. Clusters with two obstruents occur, subject to

<sup>34</sup> Exceptions are loan-words like *pigmeë* [pɪxme] 'pygmeë', *Afghaan* [ɑfxan] 'Afghan', *drachme* [drɑxmə] 'drachma', the word *imker* [ɪmkər] 'bee keeper', and the brand name *Agfa* [ʌxfə]. Nasals before another obstruent do not occur in the list of excluded clusters because they agree in place of articulation with the following consonant.

certain restrictions as given above, and even clusters in which an obstruent precedes a sonorant consonant, but these latter clusters are indeed rare. Such words are often loan-words, such as *acne* /akne/ 'id.' and *drachme* /draxmə/ 'drachma', and we also find them in family names like *Ahma* and *Postma* which historically derive from morphologically complex words.

The Syllable Contact Law is particularly strong before schwa. For instance, a form like *ordner* /ɔrdnər/ 'file' is very marked compared with *ander* /andər/ 'other', and the effect is that a consonant cluster before a schwa often has the form of a well-formed syllable coda.<sup>35</sup>

Another constraint on the segmental composition of Dutch morphemes (a constraint observed for English by Davis (1991)) is that in the sequence *sCVC* identical non-coronal obstruents are avoided. It does not play a role whether the two identical Cs belong to the same syllable or not. The following examples illustrate this constraint:

- (62) *CVC* versus *sCVC*
- |                |                    |
|----------------|--------------------|
| poep 'shit'    | *spoep             |
| toet 'face'    | stoet 'procession' |
| koek 'cake'    | *skoek             |
| gigant 'giant' | *sgigant           |

The constraint may be of a more general nature since the same restriction holds for other well-formed onset clusters  $CC_i$  followed by a vowel +  $C_i$  (where subscript  $i$  indicates identity).

- (63)
- |                |                            |
|----------------|----------------------------|
| mam 'mum'      | *smam                      |
| non 'nun'      | *snon, *knon               |
| lol 'fun'      | *slol, *plol, *klol, *blol |
| raar 'strange' | *praar, *kraar, *braar     |

Such configurations are also strange when they are heterosyllabic: \**smama*, \**knona*, \**krara*, etc. Therefore, the following constraint holds:

- (64) Identical Consonant Constraint  
\*  $CC_i - V - C_i$

Morpheme structure conditions may also have prosodic dimensions. For instance, above we saw that in lexical morphemes three-positional rhymes tend to end in an obstruent consonant. Another tendency is that short vowels do not appear so easily before obstruent + liquid clusters, as observed by Van der Hulst (1984). For instance we do not have /zɛbra/ along with *zebra* /zebra/ 'id.'. There are, however, exceptions to this constraint, as in the words *Accra* /akra/ 'id.', *agglomeratie* /aɣloməraɪ/ 'agglomerate', *hopla* /hɔpla/ 'upsy-daisy', *Biafra* /biəfra/ 'id.', *ACLO* /aklo/ (acronym), *Oslo* /ɔslo/ 'id.', *Islam*

<sup>35</sup> In Kager and Zonneveld (1986), this observation about the nature of consonant clusters before schwa is adduced as evidence for the hypothesis that word-final schwas are extra-metrical. See Kager (1989: 212–14) for criticism of this hypothesis.

/ɪslam/ 'id.', and so on. So, clearly, it is not an absolute pronounceability constraint on sequences of segments.

### 3.6. THE RELATION BETWEEN MORPHOLOGICAL AND PROSODIC STRUCTURE

Lexical morphemes of Dutch appear to be subject to the following constraints:

- they have at least one full vowel;
- they do not begin with a schwa.

This can be interpreted as follows: a lexical morpheme (i.e. a morpheme belonging to one of the lexical categories Noun, Verb, Adjective, Adverb, or Preposition<sup>36</sup>) must be able to form a well-formed prosodic word of its own, where a prosodic word is defined as a sequence of one or more well-formed syllables, at least one of which contains a full vowel. It is necessary to have at least one full vowel in a prosodic word because otherwise there is no syllable available for the location of main stress—schwa cannot bear stress—in words of major lexical categories (N, V, A). That is, a lexical morpheme minimally consists of a foot.

As pointed out in Section 3.5.4, a syllable that consists of a schwa only is ill-formed because a syllable must be specified for Place. However, a prosodic word cannot begin with a schwa, even if it is followed by a tautosyllabic consonant, that is, even though the syllable with the schwa does dominate Place. Observe that function words with the structure /ə/ + consonant do exist, for example, *een* /ən/ 'a'. This implies that such function words do not form prosodic words of their own.

Thus, the segmental string corresponding to a lexical morpheme will be dominated by a prosodic word node. The same applies to those suffixes that form an independent domain of syllabification such as *-achtig* '-like': since this string contains a full vowel and does not begin with a schwa, it will be dominated by a prosodic word node. On the other hand, function words such as determiners and pronouns can begin with a schwa, and/or have schwa as their only vowel, in particular in their weak or clitic forms. This also applies to weak (clitic) forms of some adverbs, and to prefixes and suffixes, all non-lexical morphemes. A survey of the phonological forms of these grammatical morphemes is given in Table 3.2.

In so far as they do not contain a full vowel, these morphemes will not be dominated by a prosodic word node after syllabification has applied. In the case of suffixes, which normally do not form a syllabification domain of their

<sup>36</sup> Prepositions are ambiguous: they form a class of words that cannot be extended by morphological means like the other categories, but they do project into phrases, i.e. PPs. Note that Dutch Ps do form prosodic words (except the preposition *te* /tə/ 'at'): they always contain at least one full vowel, and also have appendices, as in *naast* /nast/ 'besides'.

TABLE 3.2. *The phonological forms of grammatical morphemes*

<b>Determiners</b>		
de 'the' /də/ (+ def. art., masc., fem., sg.; def. art., pl.)	postpositions (strong form /ɛr/)	-el /əl/ (de-nominal verbalizing suff.)
het /ə/ 'the' (strong form [hɛt]) (def. art., n., sg.)	we /uə/ 'we' (strong form wij /vɛi/)	-(e)lijk /-(ə)lɔk/ 'able'
een /ən/ 'a' (indef. art., sg.)	ze /zə/ 'they' (strong form zij /zɛi/)	-en /ən/ (plural suff. (verbs and nouns))
	ze /zə/ 'them' (strong form hen /hɛn/)	-end /ənd/ (pres. part. suff.)
	z'n /zən/ 'his' (strong form zijn /zɛin/)	-(e)nis /ənɪs/ 'ness'
		-er /ər/ 'er'
		-erd /ərd/ (de-adjectival nominal suff. for personal names, pej.)
<b>Pronouns</b>		
ik /ək/ 'I' (strong form /ɪk/)	<b>Adverbs</b>	-erig /ərəɪ/ 'ish'
me /mə/ 'me' (strong form mij /mɛi/)	er /ər/ 'there' (strong form /ɛr/)	-erij /ərəi/ 'ing'
m'n /mən/ 'my' (strong form mijn /mɛin/)	daar /dər/ 'there' (strong form /dar/)	-ig /əɪ/ 'ish'
je /jə/ 'you' (subj.) (strong form jij /jɛi/)	eens /əs/ 'once' (strong form /ens/)	-sel /səl/ (de-verbal obj. names)
je /jə/ 'you' (obj.) (strong form jou /jɔu/)		-ster /stər/ (f. suff.)
je /jə/ 'your' (strong form jouw /jɔu/)	<b>Preposition</b>	-te /tə/ 'ness' (past t.)
hem /əm/ 'him' (strong form /hɛm/)	te /tə/ 'at'	-tje /tjə/ (dimin. (with allomorphs -/jə/, -/ətjə/, -/pɔə/, -/kɔə/))
haar /ər/ 'her' (strong form /har/)	<b>Prefixes</b>	
het /ə/ 'it' (strong form /hɛt/)	be- /bə/, ge- /gə/, ver- /vər/, er- /ər/ <sup>37</sup>	<b>Circumfixes</b>
d'r /dər/ 'her' (poss. pron.) (strong form haar /har/)	<b>Suffixes</b>	ge-en /gə-ən/ (past part. circumfix for strong verbs)
er /ər/ 'it' (before	-e /ə/ (f. suff.) or substantivizing suff. or inflection of attr. adjectives)	ge-t/d /gə-t/d/ (past part. for weak verbs)
		ge-te /gə-tə/ 'de-nominal collective'

own, this does not mean that the suffixal string is not dominated by a prosodic word node, because they fuse with the preceding segmental material. (Note that for suffixes that contain only schwas it is predictable that they do not form prosodic words of their own!) In the case of prefixes and (the weak forms of) determiners, pronouns, and adverbs (all independent domains of syllabification), their segmental material will be dominated by syllable nodes, but not by prosodic word nodes. As we will see, they therefore have to be prosodically integrated at the post-syntactic level of prosodic structure. This of course also

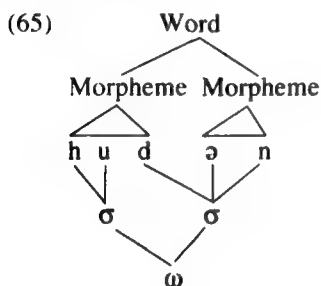
<sup>37</sup> Ver- and er- also have phonetic forms with the full vowel [e], at least for some speakers. The prefix ont- does not have a variant with schwa, presumably because after a schwa a sequence of two consonants is not possible, and because vowel reduction does not occur in vowel-initial syllables (except /ɛ/ before /r/).

applies to clitic forms like *k* 'I' and *t* 'it' which consist of a consonant only, and therefore do not even get a syllable node.

Even if a morpheme forms an independent domain of syllabification this does not guarantee that it will also be a prosodic word. For instance, the prefixes and clitic words discussed here are independent domains of syllabification, but not prosodic words.

Note that this analysis also explains why the /n/ of the strong form of the adverb *eens* /ens/ 'once' has to be dropped in its weak form [əs]: once it has only a schwa, this word cannot be a prosodic word any more, and the sequence /ns/ is no longer licensed because there is no Appendix position that can accommodate a second consonant in the syllable after the schwa which itself occupies two positions.

It is a basic insight of prosodic phonology that the prosodic structure of a word is not necessarily isomorphic to its morphological structure. For instance, the word *hoeden* 'hats' has the following two non-isomorphic structures as shown in (65).



As pointed out above, most Dutch suffixes prosodify with the stem to which they are attached, except for a special class of suffixes which form prosodic words of their own. The first type of suffix may be called 'cohering suffix', the second type 'non-cohering suffix' (cf. Booij 1982a, 1983). Each constituent of a compound forms a prosodic word of its own, as was shown above for the compound *handuppel* 'eating apple', where syllable-final devoicing applied to the word-internal /d/. This assumption is also supported by the way in which Prevocalic Schwa Deletion applies. This phonological rule of Dutch deletes schwas before vowels, thus avoiding hiatus (cf. Section 4.2.3). It applies within the domain of a word, but not across a prefix boundary, across the internal boundaries of compounds, or before the vowel-initial suffix *-achtig*. This restriction on the domain of application of schwa deletion follows straightforwardly by the assumption that this rule has the prosodic word as its domain:

(66) a. Deletion in:

kaden /kadə + ən/ 'quays' [kadən]

zýdig /zɛidə + əɣ/ 'silky' [zɛidəx]

Romein /romə + ɛin/ 'Roman' / [romɛin]



b. *No deletion in:*

zijdeachtig /zɛidə + ʌxtəy/ 'silky' [zɛidəʌxtəx]

zijdeinkomsten /zɛidə + ɪŋkɔmstən/ 'silk revenues' [zɛidəɪŋkɔmstən]

beantwoorden /bə + ʌntvordən/ 'to reply' [bəʌntvɔːrdən]

A complex word may lose its semantic transparency, however, and thus it can lose its internal morphological structure. An example of this is provided by *aardappel* 'potato'. Since a potato is no longer considered to be a kind of apple, the word *aardappel* appears to be prosodified as one word:

(67) Stage I: morphological structure<sup>38</sup> [ {aard}<sub>N</sub>{appel}<sub>N</sub>]<sub>N</sub>prosodic structure ( (aard)<sub>σ</sub>ω( ap)<sub>σ</sub>(pel)<sub>σ</sub>ω

phonetic form [a:rtʌpəl]

Stage II: morphological structure [aardappel]

prosodic structure ( (aar)<sub>σ</sub>(dap)<sub>σ</sub>(pel)<sub>σ</sub>ω

phonetic form [a:rdʌpəl]

The same development took place in the compound *tandarts* [tandarts] 'dentist' (lit. 'tooth-doctor', with the original structure *tand-arts*), and in the word *reuzachtig* [røzʌxtəx] 'fantastic' (lit. 'giant-like') with the suffix *-achtig*. In the case of *reuzachtig*, the literal interpretation 'giant-like' also exists, and then we get the phonetic form [røʌxtəx], as expected. In the prefixed verb *herinneren* 'to remember' (lit. to 're-internalize') with the prefix *her-* 're-', the effect of losing its morphological transparency is not to be seen in the voiced realization of word-internal obstruents, but in the fact that the /r/ of the prefix always forms the onset of the next syllable: (her)<sub>σ</sub>(rin)<sub>σ</sub>(ner)<sub>σ</sub>, not (her)<sub>σ</sub>(in)<sub>σ</sub>(ner)<sub>σ</sub>. The prefix *re-* may also lose its transparency, as in *reageren* 'to react' which requires obligatory insertion of a glide between the two adjacent vowels, that suggests that it has become one prosodic word.

That affixes may function as independent prosodic words correctly predicts that they are subject to the rules for word stress, which have the prosodic word as their domain. For instance, in the prefix *over-* /ovər/ 'id.' and the suffix *-achtig* /ʌxtəy/ '-like', the first syllable receives stress because the second one contains a schwa, and is therefore unstressable, completely in accordance with the Dutch word-stress rule.<sup>39</sup>

The non-isomorphy of morphological and prosodic structure is also demonstrated by the phenomenon of conjunction reduction ('gapping') in complex words (Booij 1985a): a part of a word can be omitted under identity with a part of another word, for instance (the italic part is deleted):

<sup>38</sup> The /ə/ of *aarde* /ardə/ 'earth' is deleted although it does not stand before a vowel in the same prosodic word. This schwa deletion is due to a lexically governed rule of schwa deletion that also deletes schwas before consonants, as in *bode* + *schap* → *boodschap* 'message'.

<sup>39</sup> There is a cross-linguistic tendency for prefixes to behave as independent prosodic words, or as independent domains of syllabification; cf. Booij and Rubach (1984) on English, Polish, and Dutch, and Cohn (1989) on Indonesian.

- (68) [ [land][bouw] ] en [ [tuin][bouw] ] 'agri- and horticulture'  
 [ [rood]achtig ] of [ [groen]achtig ] 'reddish or greenish'

The crucial condition is that the gapped part forms one or more prosodic words, and that it is adjacent to the conjunction.<sup>40</sup> It is not enough that there is morphological identity. For instance, the suffix *-ig*, a cohering suffix with the same meaning as *-achtig* cannot be gapped because it does not form a prosodic word of its own:

- (69) \*[ [rod] - ] of [ [groen]ig ] 'reddish or greenish'

On the other hand, the cohering suffix *-er* and the cohering suffix *-s* can be gapped together with the part of the segmental string to which they prosodically cohere. That is, *bouwers* can be gapped: although it is not a morphological constituent, it is a prosodic word:

- (70) morphology: [ [ [land][bouw] ]er]s en [ [ [tuin][bouw] ]er]s]  
 prosody: (land)<sub>ω</sub>(bouwers)<sub>ω</sub> (en)<sub>ω</sub> (tuin)<sub>ω</sub>(bouwers)<sub>ω</sub>

Thus, *land- en tuinbouwers* 'agriculturers and horticulturers' is a well-formed expression.

Gapping of the right of two identical constituents is also possible. In that case, the right prosodic word must be adjacent to the conjunction, as in *herenjassen en -schoenen* 'men's coats and -shoes'. Rightward gapping also proves that prefixes do not form independent prosodic words, although they form independent domains of syllabification: gapping of the second of two identical prefixes is impossible:

- (71) \**befietsen of—lopen* 'to cycle on or to walk on'

The two constituents of a Dutch compound often have either an /s/ or an /ə/ in between them, the so-called linking phonemes. The question when they appear is a morphological issue (cf. Van den Toorn 1982). What is relevant here is that, although the linking phonemes do not form part of one of the constituents from the morphological point of view, they fuse prosodically with the preceding prosodic word, as can be seen from the way in which they syllabify and from the fact that underlyingly voiced obstruents remain voiced before the linking schwa. For instance, *hondebrood* 'dog's food' has the following morphological and prosodic structures:

- (72) morphological structure: [ [hɔnd]<sub>N</sub>ə[brod]<sub>N</sub>]<sub>N</sub>  
 prosodic structure: ( (hɔn)<sub>σ</sub>(də)<sub>σ</sub> )<sub>ω</sub> ( (brod)<sub>σ</sub> )<sub>ω</sub>  
 phonetic form: [hɔndəbrot]

<sup>40</sup> A more correct statement of this latter condition is that the gapped constituent should occur at the periphery of a phonological phrase, since gapping also applies before a preposition as in *Hij verwisselde de dagblad-voor de weekbladjournalistiek* '(lit.) He exchanged the daily journalism for the weekly journalism' where *voor* is a preposition that begins a new phonological phrase according to the rules proposed in Nespor and Vogel (1986). Cf. Booij (1988b).

We now also make the right prediction with respect to the behaviour of such compounds under conjunction reduction: since *honde* is the first prosodic word, that will be the remnant after gapping:

(73) *honde- en kattebrood* 'dog's food and cat's food'

In sum, we have seen that the mapping of morphological structure on to prosodic structure is systematic, but not isomorphic. This insight will play an important role in the analysis of phonological processes in the following chapters.

## WORD PHONOLOGY

## 4.1. INTRODUCTION: THE ORGANIZATION OF THE GRAMMAR

A traditional distinction in the description of the phonological processes is that between word phonology and sentence phonology (cf. Booij 1981*b*). Rules of word phonology apply within words, whereas rules of sentence phonology, which are characteristic of connected speech, (also) apply in larger, phrasal

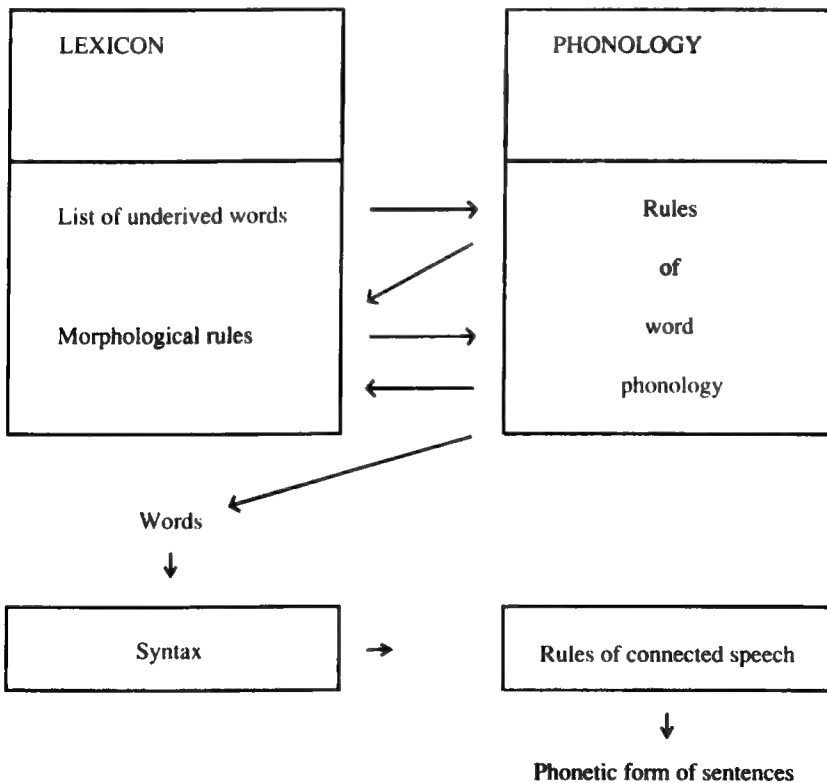


FIG. 4.1. The organization of the grammar

domains. Clear cases of rules of word phonology are the rules for word stress (Chapter 5), and the so-called morpholexical rules,<sup>1</sup> rules that are conditioned by specific morphemes or only apply to restricted sets of lexical items. For instance, the rule of Learned Vowel Backing that was introduced in Section 2.5.2 is typically a morpholexical rule because it only backs mid vowels in [-native] words. The question now is, where in the grammar the rules of phonology must be assumed to apply, and how they interact with other components of the grammar.

Suppose that we assume the following simple principle as to when phonological rules apply:

- (1) Apply a phonological rule whenever its structural description is met.

This implies that a phonological rule will apply as soon as the relevant environment is available. Since words are available in the lexicon, words that meet the structural description of a rule will, in principle, undergo that rule in the lexicon. Rules of connected speech that apply within phrases, on the other hand, can only apply after the creation of phrases in syntax. Thus, the organization of the grammar emerges as in Fig. 4.1.

The boxes around the two sets of phonological rules do not indicate completely separate subcomponents of the phonological component (some rules apply both in the lexicon and postlexically), but are meant to indicate that only a subset of phonological rules is able to interact with morphological operations, or can apply before syntax. To make this more concrete, let us look at the derivation of the word *elitarisme* 'elitism':

- |  |  |
|--|--|
| (2) 1st cycle:                         | [elitə] <sub>N</sub>   |
| 2nd cycle:                             |  |
| morphology                             | [ [elitə] <sub>N</sub> ɛ:r] <sub>A</sub>                     |
| phonology: (Prevocalic Schwa Deletion) | ∅  |
| 3rd cycle:                             |  |
| morphology                             | [ [ [elit] <sub>N</sub> ɛ:r] <sub>A</sub> ɪzmə] <sub>N</sub> |
| phonology: Learned Backing             | a  |
| Lexical phonetic form:                 | [elitarɪzmə]   |

This cyclic derivation of the word *elitarisme* follows from the assumption that morphological and phonological rules apply in tandem, the core of the theory of Lexical Phonology (Kiparsky 1982, Booij 1981*b*, Booij and Rubach 1987, 1991). By having phonological and morphological rules interspersed, it is correctly predicted that morphological rules may apply to derived phonological representations (Anderson 1979, Booij 1988*b*, Hargus 1988: 59). Since the rules of Prevocalic Schwa Deletion and Learned Backing are applicable at the lexical level, they will apply in conformity with principle (1).

However, in Chapter 3 it was argued that the rule of Prevocalic Schwa

<sup>1</sup> This term is taken from Anderson (1974).

Deletion applies within the domain of the *prosodic* word. This implies that information about the prosodic structure of words must also be generated at the lexical level. This also follows from principle (1), since prosodification rules are phonological rules. Moreover, it makes the correct prediction that morphological rules may have to refer to prosodic properties of their input words (cf. Booij 1988*b*, 1992*c*, Booij and Lieber 1993). On the other hand, the syllabification of the segmental string of a word may change due to morphological and phonological processes. For instance, the final schwa of *elite* /elitə/ is deleted before the next vowel-initial suffix. Since the schwa heads a syllable, this syllable node gets lost. Also, after the addition of *-isme* the coda of the last syllable, /r/, of *elitair* will become the onset of the first syllable of *-isme*. Therefore, I will assume the following (re)syllabification procedure (steps (a) and (b) precede (c), but are only applicable after a morphological or phonological rule has applied) (cf. Itô 1989, Rubach and Booij 1990*a*):

### (3) Continuous syllabification

- a. Coda Erasure in the word-final syllable after attachment of a cohering suffix;<sup>2</sup>
- b. erasure of the  $\sigma$ -node and the prosodic structure dominated by it if the head of  $\sigma$  (the nucleus) is deleted;
- c. matching of syllable and prosodic word templates.

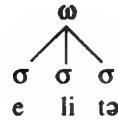
This procedure will again be illustrated by the derivation of the word *elitarisme* as given in (4).

Let us now look at the rule of syllable-final devoicing of obstruents. If it applied as early as possible, we would get wrong phonetic forms such as [hutən] for *hoeden*: on the first cycle the /d/ of the morpheme /hud/ is syllable-final, and hence it would devoice, thus resulting in the wrong phonetic form. In other words, this rule should apply after morphology: the plural suffix *-en* will induce resyllabification of the /d/ as onset of the next syllable, and hence it remains voiced, as required (Booij 1981*a*: 119). Such rules are called word-level rules since they apply after morphology, but still at the lexical level. That is, we have to allow for rules of word phonology to apply at a later level, the word level. This means that there are three levels at which rules can apply (Kiparsky 1985, Booij and Rubach 1987). The first level will be called the cyclic level because at that level morphology and phonology apply cyclically, as shown.

<sup>2</sup> Instead of Coda Erasure, Levin (1985) and Hall (1992) assume that only the last consonant of a coda can be resyllabified, through the structure-changing application of the universal CV-rule. However, there are cases in which more than one consonant has to be resyllabified, as in *angstig* (aŋ)σ(stəx)σ 'fearful' derived from *angst* (aŋst)σ 'fear'. Also, in *handje* (hən)σ(tjə)σ 'little hand' the /d/ is first syllabified as coda of the first syllable because Dutch does not allow for *dj*-onsets. This causes final devoicing, and subsequent resyllabification because *tj*- is a possible onset of Dutch. Note that resyllabification takes place here even though the onset is already filled by the consonant /j/. Cf. also Rubach and Booij (1990*a*).

## (4) 1st cycle:

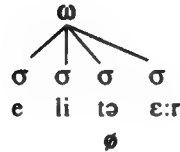
Syllabification



## 2nd cycle:

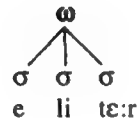
-air-affixation

+ prosodification



Prevocalic Schwa Deletion

Resyllabification

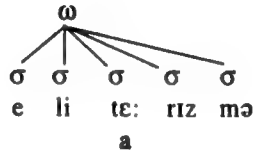
(deletion of third  $\sigma$ )

## 3rd cycle:

-isme-affixation

+ prosodification

(including Coda Erasure)



Learned Vowel Backing

Lexical phonetic form

[elitarizmə]

(5) *Levels of application*

Cyclic level

Word level

Postlexical level

By locating syllable-final devoicing at the word level, we also predict that postlexical resyllabification of consonants across word boundaries will not affect the voice properties of word-final obstruents. For instance, in the phrase *een hond aan de lijn* 'a dog on the leash' the sequence of words *hond aan* may be syllabified as  $(hɔn)_\sigma(tan)_\sigma$ , with the word-final obstruent of *hond* /hɔnd/ forming an onset. However, the underlying /d/ is devoiced, so the phonetic form [hɔndan] is impossible.

For other phonological rules of Dutch that apply obligatorily within the domain of the prosodic word there is no crucial evidence that they are cyclic rules or word level rules. This applies to the phonological (P-rules) discussed in Section 4.2. If nothing is said, they will apply as early as possible, in conformity with principle (1), hence at the cyclic level. In Chapter 5 it is shown that the Main Stress Rule for the location of main stress on words is

indeed crucially cyclic. Consequently, syllabification must also be cyclic, since stress is a property of syllables.

The cyclic application of rules is subject to the Strict Cycle Condition (Kiparsky 1985): they only apply in derived environments, unless they add information (i.e. are not structure-changing); in the latter case they may also apply in underived environments. This makes the right predictions for the phonological rules discussed in Section 4.2. since they either apply in derived environments only (for instance, Prevocalic Schwa Deletion), or they add information, and hence apply in underived environments as well, as required (e.g. Nasal Assimilation). Final Devoicing, as we have seen, is a word-level rule. This follows from the fact that it is only conditioned by syllable structure, and syllable structure does not count as derived environment (Kiparsky 1985). Hence, since it is a structure-changing rule, it will be blocked from application at the cyclic level, as required, and apply as soon as possible after the cyclic level, i.e., at the word level.

Not all phonological rules that apply within words are obligatory rules. There are also rules that optionally apply, such as Schwa Epenthesis, a rule that breaks up coda consonant clusters (as in *harp* /harp/ 'id.' pronounced as [hɑrəp]). Such rules are often stylistically governed in that they are characteristic of less monitored forms of speaking (casual speech). They will be dealt with in Chapter 6, and will be argued to belong to the postlexical level.

In this chapter I will discuss phonological processes that apply obligatorily within words, with the exception of word stress which is dealt with in Chapter 5. Chapter 6 analyses optional rules that apply within words, and Chapter 7 deals with rules of connected speech above the word, which are of course located at the postlexical level.

## 4.2. PHONOLOGICAL RULES

Phonological alternations differ as to the nature of their conditioning environments. Some alternations, such as that between voiced and voiceless obstruents in morpheme-final position are conditioned by phonological conditions only, in this example the position of the obstruent in the syllable. Such rules are called 'automatic phonological rules', phonological rules, or P-rules. Other alternations are also conditioned by non-phonological factors. For instance, the alternations in Dutch diminutive nouns are conditioned crucially by the presence of the diminutive suffix, and these alternations do not occur in other types of complex word. Rules which only apply to words with specific morphemes or to specific sets of items that are not characterizable in purely phonological terms, are called morpholexical rules or MP-rules (Anderson 1974). This section will deal with P-rules, Sections 4.3 to 4.5 with MP-rules.

P-rules that apply obligatorily within the domain of the prosodic word form



part of the lexical phonotactics of a language, i.e., they define constraints on the notion 'possible prosodic word of language L'. In this respect they differ from MP-rules, which do not have such a phonotactic role. For instance, there is an MP-rule that inserts a schwa before the diminutive suffix after a short vowel followed by a sonorant consonant, as in *kannetje* /kən+tjə/ 'small jug' with the phonetic form [kənətjə]. Nevertheless, this does not mean that /n/ and /t/ cannot be adjacent in this phonological configuration, as is proven by the existence of another diminutive, *kantje* /kant+tjə/ 'piece of lace' with the phonetic form [kantjə]. This shows that the MP-rule of Schwa-insertion does not have a phonotactic role, and why it is important to distinguish these two kinds of rule. Related to this, MP-rules can have lexical exceptions, as illustrated below, which is understandable because they do not express absolute constraints on possible sequences of sounds within a prosodic word, whereas P-rules do not have exceptions at the lexical level.

#### 4.2.1. Devoicing and voice assimilation

Dutch has the following two P-rules of voice assimilation, traditionally called Progressive Assimilation and Regressive Assimilation respectively.<sup>3</sup>

The rule of Progressive Assimilation says that a fricative is devoiced after a voiceless obstruent:

##### (6) *Progressive Assimilation*

opvallend 'remarkable'	/pv/ [pf]
stoepzout 'pavement salt'	/pz/ [ps]
opgraving 'excavation'	/pɣ/ [pɣ]
zourvat 'salt tub'	/tv/ [tʃ]
zourzuur 'hydrochloric acid'	/tz/ [ts]
straa/goot 'gutter'	/tɣ/ [tɣ]
dakvenster 'dormer'	/kv/ [kf]
dakgoot 'gutter'	/kɣ/ [kɣ]
afval 'trash'	/fv/ [f:]
afzuigen 'to extract'	/fz/ [fs]
afgang 'failure'	/fɣ/ [fx]
asvat 'ashbin'	/sv/ [sf]
waszak 'laundry bag'	/sz/ [s:]
wasgoed 'laundry'	/sɣ/ [sx]
pechvogel 'unlucky person'	/xv/ [xf]
lachzak 'laughing machine'	/xz/ [xs]
lachgas 'laughing gas'	/xɣ/ [x:]

In three examples we see a geminate fricative in the phonetic form. These geminates are usually shortened through Degemination (Section 4.2.4).

<sup>3</sup> Cf. Tops (1974), Van der Hulst (1980), Booij (1981a), and Zonneveld (1983).

All these examples are complex words, consisting of at least two prosodic words, that is, we may call them prosodic compounds. Note that obstruent clusters of this type are very rare within morphemes: they do not form optimal syllable contacts (cf. Section 3.5.5). Nevertheless, there is evidence that this devoicing rule also applies within prosodic words, as in *advies* [ɑtfis] 'advice' and in acronyms like *ABVA* /ɑbva/ [ʌpfa] and *AKZO* /akzo/ [akso]. Phonological rules like Progressive Assimilation, which apply obligatorily within prosodic words and compounds, become optional in larger domains: for instance, in phonological phrases.

The rule of Progressive Assimilation is fed by Final Devoicing since obstruents that are voiceless due to the latter rule also devoice when they follow underlyingly voiced fricatives:

- |                                  |           |
|----------------------------------|-----------|
| (7) <i>handzaam</i> 'handy'      | /dz/ [ts] |
| <i>hebzucht</i> 'avarice'        | /bz/ [ps] |
| <i>graafzucht</i> 'digging urge' | /vz/ [fs] |

The second rule of voice assimilation is that of Regressive Assimilation. It says that voiceless obstruents become voiced before a following voiced stop (i.e. /b/ or /d/):

(8) *Regressive Assimilation*

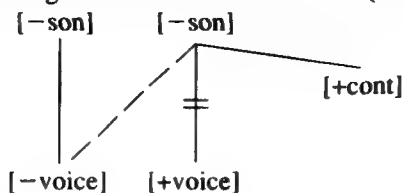
<i>klaphand</i> 'flat tyre'	/pb/ [b:]
<i>opdruk</i> 'imprint'	/pd/ [bd]
<i>eethaar</i> 'edible'	/tb/ [db]
<i>potdicht</i> 'tight'	/td/ [d:]
<i>kookhoek</i> 'cookery book'	/kb/ [gb]
<i>zakdoek</i> 'handkerchief'	/kd/ [gd]
<i>afbellen</i> 'to ring off'	/fb/ [vb]
<i>stofdoek</i> 'duster'	/fd/ [vd]
<i>kashoek</i> 'cash book'	/sb/ [zb]
<i>misdaad</i> 'crime'	/sd/ [zd]
<i>lachhui</i> 'fit of laughter'	/xb/ [ɣb]
<i>lachduif</i> 'laughter'	/xd/ [ɣd]

In this case, the effects of Final Devoicing are undone by voice assimilation. For instance, in *niesbui* 'fit of sneezing', the *s* represents an underlying /z/ (witness *niezen* 'to sneeze'), which can be devoiced in coda position, but is then revoiced before the next /b/. As was the case with Progressive Assimilation, the rule applies both within and across prosodic word boundaries. The effects within prosodic words may be seen in words like *asbest* [azbest] 'asbestos' and *Lesbos* [lezbɔs] 'id.'.

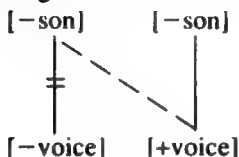
The two rules of voice assimilation can be formulated as in (9) and (10).

Since PVA is a more specific rule than RVA, PVA will apply first in accordance with the Elsewhere Principle (Kiparsky 1982) which says that when two rules compete, the more specific one gets priority, and blocks application of the other one. Once PVA has applied, for instance to *zoutvat*

## (9) Progressive Voice Assimilation (PVA)



## (10) Regressive Voice Assimilation (RVA)

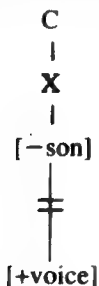


'salt tub', thereby devoicing the /v/, the application of RVA is no longer possible anyway, since the second obstruent no longer bears the feature [+voice].

No ordering of PVA with respect to Final Devoicing is necessary for words like *hebzucht* 'avarice', with the underlying cluster of obstruents /bz/: the application of Final Devoicing will feed PVA: first the /b/ turns into [p], and this [p] changes the following /z/ into [s].

When at the word level the rule of Final Devoicing applies to a word like *handboei* /handbuij/ 'handcuff', with underlyingly voiced obstruents, the /d/ will be devoiced, and then revoiced by RVA. Then, Final Devoicing cannot reapply, because RVA has created a structure in which the feature [+voice] is doubly linked, to both obstruents, and therefore the Uniform Applicability Condition (cf. Section 3.4.2) will block another application of Final Devoicing, which has the form given in (11).<sup>4</sup>

## (11) Final Devoicing



<sup>4</sup> Obstruents in Appendix position also devoice. We might therefore assume that, at the word level, appendix consonants are Chomsky-adjoined to the Coda. Another solution is proposed by Lombardi (1991): the feature [+voice] is only licensed in Onset position, and therefore delinked by convention in all other positions, i.e. Coda and Appendix. This analysis makes Chomsky-adjunction of appendices to codas superfluous. Gussmann (1992: 42), in his analysis of Polish voice assimilation, assumes the same restriction as to the licensing of [+voice] for Polish.

The rules of voice assimilation do not apply only within words, but also across (grammatical) word boundaries, that is, in phrases. That is, the rules apply postsyntactically because their domain of application, the Intonational Phrase, will only be available postsyntactically. However, in larger domains the application of such rules is not completely obligatory and can be suppressed.<sup>5</sup> I already mention them here, in the chapter on word phonology, because they apply obligatorily within the smaller domain of the word.

Another complication as to the phrasal application of these rules is that the demonstratives *die* 'that' and *dat* 'that' can be optionally subject to Progressive Voice Assimilation. Thus, we find the following phonetic realizations for *dat* and *die* in the sentence *Is dat juist, op die manier?* 'Is that OK, in that manner?' (Van Haeringen 1955):

(12) [ɪzdat] or [ɪstət], [ɔbdi] or [ɔpti]

In Section 8.3. it is shown that these facts follow from the optional encliticization of these function words to a preceding word.

Verbal inflectional suffixes exhibit a different behaviour with respect to voice assimilation, which requires detailed discussion.

The Dutch past-tense suffix for regular ('weak') verbs is /tə/ or /də/: /tə/ after stem-final underlyingly voiceless obstruents, and /də/ elsewhere, i.e., after voiced obstruents, sonorant consonants and vowels:

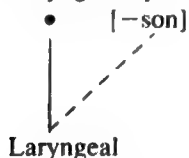
(13) a. stem		past tense	
a.	klap /klap/ 'to applaud'	klapte	[klaptə]
	zet /zɛt/ 'to put'	zette	[zɛtə]
	haak /hak/ 'to crochet'	haakte	[haktə]
	maf /maf/ 'to sleep'	mafte	[mɔftə]
	vis /vɪs/ 'to fish'	viste	[vɪstə]
	lach /lax/ 'to laugh'	lachte	[lɔxtə]
b.	krab /krab/ 'to scratch'	krabde	[krabdə]
	red /rɛd/ 'to save'	redde	[rɛdə]
	kloof /klov/ 'to split'	kloofde	[klovdə]
	raas /raz/ 'to rage'	raasde	[razdə]
1	leg /lɛɣ/ 'to lay'	legde	[lɛɣdə]
c.	roem /rum/ 'to praise'	roemde	[rumdə]
	zoen /zun/ 'to kiss'	zoende	[zundə]
	meng /mɛŋ/ 'to mix'	mengde	[mɛŋdə]
	roer /rur/ 'to stir'	roerde	[ruːrdə]
	rol /rɔl/ 'to roll'	rolde	[rɔldə]
	aai /aj/ 'to caress'	aaide	[ajdə]
	ski /ski/ 'to ski'	skiede	[skidə]

<sup>5</sup> According to Cammenga and Van Reenen (1980) RVA of /s/ is also optional in compounds like *misdad* 'crime' and *niesbui* 'fit of sneezing' which consist of two prosodic words, and in which therefore the two obstruents are separated by prosodic word boundaries.

The past-tense forms given here are the singular forms. The plural forms are created by adding the verbal plural suffix *-en /ən/*. The final schwa of the past-tense suffix deletes before the plural suffix due to the rule of Prevocalic Schwa Deletion, and thus the surface forms of the past tense plural forms consist of the verbal stem plus /dən/ or /tən/ (e.g. *klapten*, *krabden*, *roemden*).

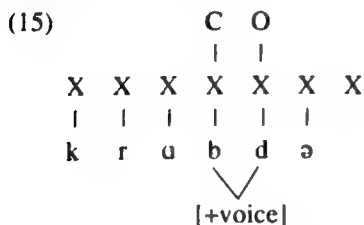
The first question to be answered is: why do not we just say that there are two competing past-tense suffixes, which appear in complementary environments?<sup>6</sup> The reason is that in such an analysis we would not account for the fact that the two suffixes are almost identical, and that, moreover, the variation is not purely arbitrary from a phonological point of view: the variant with the voiceless consonant shows up after voiceless sounds. It would be easy to describe a situation in which *-te* appeared after voiced segments, and *-de* after voiceless segments. Therefore, a phonological analysis is called for. I will assume an underlying form /Də/, where the initial coronal stop is unspecified for [voice], and a P-rule that spreads the Laryngeal node from the preceding segment to the underspecified coronal stop (the '•' indicates the root):

(14) Laryngeal Spreading



Since the laryngeal node dominates either [+voice] or [-voice], the past tense suffix is either [də] or [tə].<sup>7</sup>

The question now arises why syllable-final voiced obstruents in past-tense forms such as *krabde* /krəb-də/ [krəbdə] 'scratched' are not subject to syllable-final devoicing. The relevant part of the representation of *krabde* will then be as in (15) (for ease of exposition I refer directly to the feature [voice] instead of the class node Laryngeal):



<sup>6</sup> Cf. Van Marle (1985) for an analysis of competing affixes in Dutch. Carstairs (1988) has shown that even when the choice between competing suffixes is determined by phonological properties of the stem, this does not necessarily imply that the suffixes derive from a common underlying form.

<sup>7</sup> Zonneveld (1983) proposed to account for the progressive assimilation of the /d/ of the past-tense suffix by positing an underlying dental fricative for the /d/ which is then subject to the rule of Progressive Voice Assimilation. Such an abstract solution is made superfluous here.


Representation (15) will not be subject to rule (11) due to the Uniform Applicability Condition (UAC). Alternatively, as pointed out above, we may assume, with Lombardi (1991), that there is no rule of Syllable-final Devoicing, but that the feature [+voice] is only licensed in onsets, and that, through the double linking, this feature is also licensed for the /b/. In other words, this would be a case of 'parasitic licensing'.<sup>8</sup>

The role of the UAC also appears to be crucial when we take another /t/-/d/ alternation into account. The past participles of regular verbs are formed by prefixing *ge-*, unless the verb begins with a [+native] prefix that does not bear stress, and by suffixing /t/ to the stem if the stem ends in a voiceless obstruent, and /d/ elsewhere. In other words, we have the same regularity here as with respect to past-tense suffixes, and the same rule of Laryngeal Spreading applies:

(16) Verb	Past participle
klap 'to applaud'	ge-klap-t
krab 'to scratch'	ge-krab-d
roem 'to praise'	ge-roem-d
ski 'to ski'	ge-skie-d

The /d/ only shows up if the participle is inflected, that is, followed by a schwa, because then it occurs in an onset. If it remains in word-final position, it will devoice due to Syllable-final Devoicing. In the case of *gekrabd*, all final obstruents will be voiceless, so /bd/ is realized as [pt].

The representation of *gekrabd* will look as follows after the application of Laryngeal Spreading:

(17)	X	X	X	X	X	X	X	X
	ɣ	ə		k	r	u	b	d
								
							[+voice]	

The UAC correctly predicts that in this configuration, Syllable-final Devoicing applies because both obstruents are dominated by the Coda node (the second one, the appendix consonant, after being Chomsky-adjoined to the coda), and thus we get the correct phonetic form [ɣəkɾɒpt].<sup>9</sup>

The rule of Laryngeal Spreading may also be used to underspecify word-internal voiced stops in words like *Bagdad* [bɑyɖɑt] 'Baghdad' and *Egbert* [ɛɣbɔrt] 'id.' (male name). Laryngeal Spreading will then create obstruent

<sup>8</sup> Cf. Goldsmith (1990: 335–6) for the notions 'prosodic licensing' and 'parasitic licensing'. Goldsmith also observes that coda positions license fewer features than onset positions. 'Geminate, however, are associated with both a coda position and an onset position, so, while they get their licensing from their onset position, they then give rise to the presence of segmental material in the coda that would otherwise not have a chance of appearing there' (1990: 336).

<sup>9</sup> Note, however, that the Linking Constraint (Hayes 1986) would block application of Syllable-final Devoicing, which is incorrect, since the phonetic form [ɣəkɾɒpt] must be derived.

clusters doubly linked to [+voice], which are thus exempted from Final Devoicing, as is required. More generally, Laryngeal Spreading may be used to express the fact that in underived sequences obstruent clusters always agree in voice. For instance, the voicelessness of the /t/ in *akte* 'act' need not be specified in its underlying form.

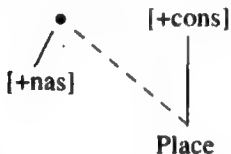
#### 4.2.2. Nasal assimilation

In many languages nasal consonants are often homorganic with a following obstruent. This is also the case in Dutch. In particular, tautosyllabic nasal-obstruent clusters are always homorganic. The only systematic exceptions are nasal consonants followed by a coronal consonant, the appendix consonants. Such clusters occur usually in morphologically complex forms.

- (18) [m] *damp* 'damp', *ramp* 'disaster', *gember* 'ginger'  
 [ŋ] *kamfer* 'camphor'  
 [n] *tand* 'tooth', *kant* 'side', *rund* 'cow'  
 [ŋ̃] *oranje* 'orange', *Spanje* 'Spain', *bonje* 'fight'  
 [ŋ] *dank* 'thank', *bank* 'couch', *zink* 'sink', a[ŋɣ]list 'anglicist', ta[ŋg]o  
 'id.'

Consequently, in this configuration nasals need not be specified for Place, and the Place features will be spread from the following consonant as shown in (19).

#### (19) Nasal Assimilation



Within morphemes, heterosyllabic nasal-obstruent clusters are usually also homorganic, as illustrated in (18). In a few words this is not the case, for instance in *imker* 'bee keeper'. Therefore, the nasal of this word has to be specified as Labial underlyingly. Likewise, in *zing+t* 'sings', the velar nasal will already be specified as such in the morpheme *zing* /zɪŋ/.

In compounds and phrases it is the coronal nasal /n/ only that assimilates to a following consonant. Examples are the following, with the prepositions *aan* /an/ 'to' and *in* /ɪn/ 'id.' and the negative prefix *on-* /ɔn/:

- |                           |               |
|---------------------------|---------------|
| (20) in Parijs 'in Paris' | [ɪmparɛis]    |
| aanbod 'offer'            | [ambɔt]       |
| onfatsoenlijk 'indecent'  | [ɔŋfatsunlək] |
| onvast 'unstable'         | [ɔŋvɑst]      |
| onwaar 'untrue'           | [ɔŋvɑ:r]      |
| onmogelijk 'impossible'   | [ɔmoɣələk]    |
| in Madrid 'id.'           | [ɪmadrit]     |

onjoviaal 'unjovial'	[ɔŋjovijal]
in juli 'in July'	[ɪŋjyli]
onkies 'indecent'	[ɔŋkis]
in chaos 'in chaos'	[ɪŋxɑɔs]
ongewoon 'uncommon'	[ɔŋɣəʋon]

Non-coronal nasals do not assimilate, as illustrated by the following examples:

- (21) wangzak 'cheek-pouch' \*[ʋanzak]  
damkampioen 'draught champion' \*[dɑŋkampijun]

This restriction to /n/ can be accounted for if we assume that the morpheme-final coronal nasal is unspecified as to Place. It will then receive its place specification from Nasal Assimilation if it occurs before a consonant-initial word in the domain in which Nasal Assimilation applies.<sup>10</sup> If not, a default rule will provide the Place specification [Coronal] at the end of the phonological derivation, thus expressing that [Coronal] is the unmarked value for Place with respect to nasals.<sup>11</sup> However, in Section 4.3.2 it will be shown that certain rules of Lexical Phonology have to refer to the feature [Coronal] of nasals. In Chapter 6 it will be argued that there are additional reasons for specifying coronal nasals as such before the end of the phonological derivation.<sup>12</sup> This implies that rule (19) cannot be taken to cover all cases of nasal assimilation: a separate feature-changing postlexical rule for the assimilation of the coronal nasal is required.

#### 4.2.3. *Hiatus rules*

Two adjacent vowels within a Dutch prosodic word are very rare. In other words, Dutch does not favour word-internal onsetless syllables. The first vowel will always be long because syllables cannot end in a short vowel (Section 3.3). If the first vowel is /a/, a glottal stop will be inserted at the phonetic level if the next vowel belongs to the syllable with main stress:<sup>13</sup>

- (22) paélla /paɛlja/ 'id.' [paʔɛlja]  
aórta /aɔrta/ 'id.' [aʔɔrta]  
Kaúnda /kaunda/ 'id.' [kaʔunda]  
versus  
cháos /xɑɔs/ 'id.' [xɑɔs]  
fárao /farao/ 'Pharaoh' [farao]

<sup>10</sup> The domain specifications of rules will be discussed in Chapter 7.

<sup>11</sup> Cf. Paradis and Prunet (1989, 1991) for cross-linguistic evidence for this claim.

<sup>12</sup> This conclusion is confirmed by the findings of McCarthy and Taub (1992) and Hall (1993) with respect to Coronal underspecification for English and German respectively.

<sup>13</sup> Jongenburger and Van Heuven (1991) showed that a glottal stop is always inserted before a vowel-initial word after a pause. According to Gussenhoven (personal communication) word-internal glottal-stop insertion only occurs in foot-initial position, i.e. not in words like *cháos* 'id.' and *fárao* 'Pharaoh'.



If the first vowel is a schwa, the schwa will be deleted. In all other cases except after /a/ a homorganic glide will be inserted between the two vowels. I will first present the data concerning Homorganic Glide Insertion (HGI). The generalization is that the inserted glide has the same properties with respect to backness and roundness as the preceding vowel (Gussenhoven 1980: 177). Moreover, the glides are predictably high:<sup>14</sup>

(23) *After rounded front vowels*

dúo /dyo/ 'id.'	[dyʊo]
flúor /flyɔr/ 'id'	[flyʊɔr]
fondúen /fɔndyən/ 'fondue' (verb)	[fɔndyʊən]
úien /æyən/ 'onions'	[æyʊən]
réuen /røən/ 'male dogs'	[røʊən]
Éduard /edyard/ 'id.'	[edyʊart]
januári /janyari/ 'January'	[janyʊari]
intuítie /intyiti/ 'intuition'	[intyʊitsi]
ruíne /ryinə/ 'ruin'	[ryʊinə]

*After unrounded front vowels*

dieet /diet/ 'diet'	[dijet]
bioscoop /biɔskop/ 'cinema'	[bijɔskop]
Indriaas /Indrias/ 'Andrew'	[Indrijas]
Gea /ɣea/ 'id.' (f. name)	[ɣeja]
Geo /ɣeo/ 'id.' (m. name)	[ɣejo]
zee+en /zɛən/ 'seas'	[zejən]
ree+en /rɛən/ 'deer'	[rejən]
vijand /vɛiənd/ 'enemy'	[vɛijənt]

*After back vowels*

Ruanda /ruanda/ 'Rwanda'	[ruvanda]
Boaz /boas/ 'id.'	[boʊas]
hou+en /hɔuən/ 'hold' (Verb)	[hɔʊvən]

Note that the front rounded glide [ɥ] does not occur as an underlying segment in Dutch. This explains why native speakers of Dutch are inclined to interpret this glide as either [j] or [ʊ], depending on the stress pattern, or give variant answers to the question 'which glide occurs in a word like *duo*?' In particular, after a front round vowel with main stress the glide is often perceived as [j].

Given this array of facts, it seems appropriate to split the formalization of HGI into two parts: insertion of an X-position, and subsequent spreading of the features of the preceding vowel as given in (24).

The glide with the feature specification [+back] will surface as [ʊ], the glide

<sup>14</sup> The first generative analysis of HGI is presented in Zonneveld (1978: 64–73). As Gussenhoven (1980) has pointed out, there are three rather than two transitional glides. My analysis is based on Gussenhoven (1980).

## (24) Homorganic Glide Insertion

a. Insert X in the context  $\begin{bmatrix} +\text{voc} \\ +\text{high} \end{bmatrix} \text{ — } [+ \text{voc}]$

b. Spreading

```

      X      X
      |      /
      |-----
      [+voc]
  
```

with the feature specification  $[-\text{back}, -\text{round}]$  as  $[j]$ , and the glide with  $[-\text{back}, +\text{round}]$  as  $[ɥ]$ .<sup>15</sup> If the first vowel is  $/e/$  or  $/o/$ , the feature  $[+\text{mid}]$  which is spread to the glide position, will change into  $[-\text{mid}]$  by convention since glides are predictably high, that is,  $[+\text{high}, -\text{mid}]$  (cf. Booij 1989a). Note, moreover, that the inserted vocoid will be predictably interpreted as a consonant since it occurs after long vowels. Finally, note that the back glide is labiodental rather than bilabial, whereas the preceding back vowels are bilabial. This is predictable since the Dutch rounded back glide is always labiodental.

The rule of HGI does not imply that  $[j]$  is never to be found after back vowels since, as shown in Section 3.5.5,  $/j/$  does occur there at the underlying level, as in *loeien*  $/luj+ən/$  'to moo', with the first-person singular form *loei*  $/luj/$ . There are a few pairs of words such as *koe* 'cow'  $[ku]$  — *koeien* 'cows'  $[kujən]$  where we have to assume two lexical allomorphs, in this case  $/ku/$  and  $/kuj/$ .<sup>16</sup>

The domain of obligatory HGI is clearly the prosodic word since there is no obligatory insertion of a glide at the boundary between the constituents of a compound or other complex words consisting of more than one prosodic word. Usually, a glottal stop is inserted at the beginning of a vowel-initial prosodic word. Yet, it is possible to insert glides in such environments in casual speech. As will be discussed in Section 7.2, many phonological rules exhibit the property that they are obligatory within the prosodic word, and optional in larger domains:

- (25) *koeachtig* 'cow-like'  $[kuʔəxtəx]$  or  $[kuvəxtəx]$   
*zeearend* 'sea eagle'  $[zeʔarənt]$  or  $[zejarənt]$

The second hiatus rule is that of Prevocalic Schwa Deletion which also applies obligatorily within a prosodic word:

- (26) *Romein*  $/romə+ɛin/$  'Roman'  $[romɛin]$   
*elitair*  $/elitə+ɛ:r/$  'elitist'  $[elitɛ:r]$   
*codeer*  $/kodə+er/$  'encode'  $[kodɛ:r]$   
*kaden*  $/kadə+ən/$  'quays'  $[kadən]$

<sup>15</sup> As shown by Van Heuven and Hoos (1991), inserted glides have a distinctly shorter duration than underlying glides. The former are transitional glides only. This is reflected by the representations for the inserted glides proposed here, namely as Xs that are linked to the Place features of the preceding vowel.

<sup>16</sup> Some southern dialects of Dutch only have the form  $/kuj/$ , i.e. the singular form of 'cow' is *koei*.

Since the domain of application is the prosodic word, the prevocalic schwa in the following words will normally be pronounced:

- (27) *zijd*[ə]-achtig 'silk-like'  
*b*[ə]-antwoorden 'to reply'  
*mod*[ə]-opleiding 'fashion academy'

In casual speech the schwa may also be deleted across prosodic word boundaries, but hardly ever if the schwa forms part of a prefix. This will be discussed in Section 7.2.3.

The rule of Prevocalic Schwa Deletion will therefore read as in (28).

- (28) Prevocalic Schwa Deletion  
 Delete X X before [-cons]  
           |  
       [-cons]<sub>u</sub>

Glide Insertion will not apply after a schwa, as required, because Homorganic Glide Insertion only applies after vowels specified as [+high], a feature that the schwa does not bear.

#### 4.2.4. Degemination

Dutch does not allow for geminate consonants within prosodic words. Consequently, degemination is obligatory within prosodic words as soon as a cluster of two identical consonants arises. In larger domains such as compounds and phrases the rule is optional. The following examples, of course all complex words, illustrate this process:

- |  |                     |
|--|---------------------|
| (29) <i>eet</i> /et+t/ 'to eat' (3 sg. pres.)    | [et]                |
| <i>voedt</i> /vud+t/ 'to feed' (3 sg. pres.)     | [vut] <sup>17</sup> |
| <i>zette</i> /zɛt+tə/ 'to put' (past)            | [zɛtə]              |
| <i>voedde</i> /vud+də/ 'to feed' (past)          | [vudə]              |
| <i>gezet</i> /ɣɛ+zɛt+t/ 'to put' (past part.)    | [ɣɛzɛt]             |
| <i>gevoed</i> /ɣə+vud+d/ 'to feed' (past part.)  | [ɣəvut]             |
| <i>kiest</i> /kis+st/ 'delicate' (superl.)       | [kist]              |
| <i>kies</i> /kis+s/ '(something) delicate'       | [kis]               |
| <i>grootte</i> /ɣrot+tə/ 'size'                  | [ɣrotə]             |
| <i>fietster</i> /fits+stər/ 'cyclist' (fem.)     | [fitstər]           |
| <i>onmiddellijk</i> /ɔn+mɪdəl+lək/ 'immediately' | [ɔmɪdələk]          |

The suffix *-sel* appears systematically to exclude base words ending in /s/ or /z/, thus obviating the need for degemination in *-sel*-words (Booij 1977: 123).

Since the rule is optional across prosodic word boundaries, it is possible to differentiate phonetically between complex words with and without a geminate, as in the following examples:

<sup>17</sup> The /d/ first becomes /t/ through the Final Devoicing rule (11) given in Section 4.2.1

- (30) *ver-assen* 'to cremate' [vɛrɑsən]  
*ver-rassen* 'to surprise' [vɛr:ɑsən]

The rule of Degemination (31) deletes one of two adjacent identical consonants.

- (31) Degemination

$$\begin{array}{ccc} X_i & X_i & \rightarrow X_i \\ | & | & | \\ [+cons] & [+cons] & [+cons] \end{array}$$

Domain:

Obligatory in prosodic words, optional in larger domains

### 4.3. MORPHOLEXICAL RULES

#### 4.3.1. Diminutive allomorphy

The Dutch diminutive suffix has five allomorphs: *-tje*, *-je*, *-pje*, *-kje*, and *-etje*. This suffix appears mostly after nouns, but also after some underived adjectives (e.g. *blondje* 'blond girl' < *blond* 'id.'), some verbs (e.g. *speeltje* 'toy' < *speel* 'to play'), and a few prepositions (for example, *uitje* 'outing' < *uit* 'out'), and creates neuter nouns. The regularities as to where the different allomorphs appear can be summarized as follows (Cohen 1958, Ewen 1978, Gussenhoven 1978, Booij 1981a, Trommelen 1984):

- (a) *-je* [jə] appears after stem-final obstruents;
- (b) *-etje* [ɛtjə] appears after sonorant consonants if preceded by a short vowel with primary or secondary stress;
- (c) *-pje* appears after /m/ except in the cases sub (b);
- (d) *-kje* appears after /ŋ/ except in the cases sub (b);
- (e) *-tje* appears elsewhere.

The following diminutives illustrate the use of the different allomorphs (the accent ' above a vowel letter indicates main stress, and the accent ` indicates secondary stress):

- (32) a. allomorph *-je*

lip 'id.'	lipje [lɪpjə]
hand 'id.'	handje [hʌntjə]
hek 'gate'	hekje [hɛkjə]
lief 'sweet'	liefje [lɪfjə]
klas 'class'	klasje [klɔsjə]
lach 'laugh'	lachje [lɔxjə]

- b. allomorph *-etje*

ríng 'ring'	ringetje [rɪŋɛtjə]
seríng 'lilac'	seringetje [sɛrɪŋɛtjə]
léerlíng 'pupil'	leerlingetje [le:rɪŋɛtjə]

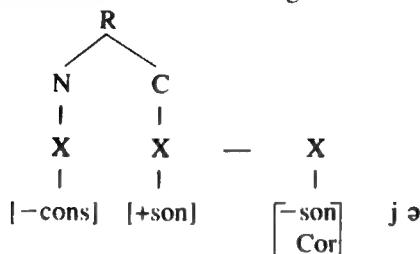
wándeling 'walk'	wandelingetje [vándəlɪŋətjə]
bóemeràng 'boomerang'	boemerangetje [buməɾəŋətjə]
bom 'bomb'	bommetje [bɔmətjə]
bon 'ticket'	bonnetje [bɔnətjə]
hórizòn 'id.'	horizonnetje [ho:ɾizɔnətjə]
bal 'ball'	balletje [balətjə]
tor 'beetle'	torretje [tɔrətjə]
hotél 'id.'	hotelletje [hotələtjə]
kanón 'gun'	kanonnetje [kanɔnətjə]
<i>c. allomorph -pje</i>	
riem 'belt'	riempje [rimpjə]
bódem 'bottom'	bodempje [bɔdəmpjə]
helm 'helmet'	helmpje [hɛlmpjə]
álbum 'id.'	alumpje [albɪmpjə]
válium 'id.'	valiumpje [valijəmpjə] <sup>18</sup>
wígwam 'id.'	wigwampje [vɪxwəmpjə]
<i>d. allomorph -kje</i>	
kóning 'king'	koninkje [konɪŋkjə]
páling 'eel'	palinkje [palɪŋkjə]
sárong 'id.'	saronkje [sarɔŋkjə]
kámpong 'village'	kamponkje [kəmpɔŋkjə]
<i>e. allomorph -tje</i>	
ree 'deer'	reetje [retjə]
stro 'straw'	strootje [strotjə]
traan 'tear'	traantje [trantjə]
wiel 'wheel'	wieltje [viltjə]
haar 'hair'	haartje [ha:rtjə]
doctor 'id.'	doctortje [dɔktɔrtjə]
ponton 'pontoon'	pontontje [pɔntɔntjə]
professor 'id.'	professortje [prɔfɛsɔrtjə]

We would like to express the phonological similarity of the five diminutive suffixes by deriving them from one underlying form, /tjə/, through a number of MP-rules. Note also that the choice of a specific allomorph is not completely arbitrary. For instance, the *p*-initial variant appears after a stem-final /m/, and the *k*-initial variant after the velar nasal, suggesting that some kind of Place assimilation is involved. The deletion of /t/ ties in with the tendency in Dutch to simplify clusters of obstruents through /t/-deletion. Note, however, that it is normally the nasal consonant that assimilates to a following obstruent, whereas here it is the obstruent that assimilates to a preceding nasal. This emphasizes the

<sup>18</sup> Since the letter *u* in *valium* can be interpreted as /v/ as well, an alternative diminutive form also occurs: *valiummetje*. In this latter form the final syllable of the base word receives secondary stress, hence the allomorph *-etje*.

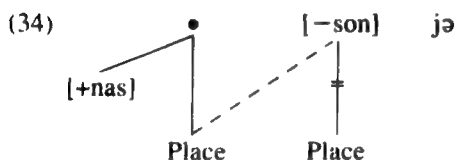
differences between the P-rule of Nasal Assimilation and the assimilatory MP-rules involved here. The MP-rules can now be formulated as in (33)–(35).<sup>19</sup>

(33) Insert /ə/ in the following context:



Condition:

R is the rhyme of a stressed syllable



(35) Delete [-son, Cor] in the context [-son] — jə

In the case of a word like *seringetje*, underlyingly /səriŋ+tjə/, rule (33) will have to take precedence over rule (34), and therefore, rule (33) has to be ordered before rule (34).<sup>20</sup>

As may be expected in cases of allomorphy governed by MP-rules, there are exceptional diminutive forms. First, there is a number of words that in addition to the regular form also have a variant with *-etje*:

(36)	Regular form	Variant
wiel 'wheel'	wieltje	wieletje
bloem 'flower'	bloempje	bloemetje
Jan 'John'	Jannetje 'Jane'	Jantje 'Johnny'
brug 'bridge'	brugje	bruggetje
weg 'road'	wegje	weggetje
heg 'hedge'	hegje	heggetje

<sup>19</sup> I will refer to specific segments by means of the corresponding phonemic symbol when no phonological generalization is involved. We might also represent the first segment of the diminutive suffix without the specification Coronal. In that case, the rules that derive *-pje* and *-kje* do not have to delink the feature [Coronal], and can be restricted to a spreading operation. The feature [Coronal] would then be filled in by a default rule that says that [Coronal] is the default value for consonants. The proposal can be found in Lahiri and Evers (1991: 97). However, as pointed out in the next section, the feature [Coronal] has to be available at the lexical level.

Trommelen (1984) is an attempt to derive the different allomorphs without stress conditions (cf. Booij (1984) for a review). However, from a theoretical point of view the fact that allomorphy is dependent on stress is not embarrassing at all, since the stress patterns of the base words have already been derived when the rules of diminutive allomorphy apply.

<sup>20</sup> This is not predicted by the Elsewhere Principle since the set of representations to which (33) applies is not a subset of that for (34); rather, the sets are overlapping.

In the case of *bloemetje* there is also semantic differentiation: *bloemetje* can also mean 'bunch of flowers', unlike *bloempje*. Trommelen (1984: 48) observes that some native speakers of Dutch are also inclined to insert a schwa after stems ending in short vowel + sonorant consonant, although the vowel does not bear main stress, for example, *wigwammetje*, *kampongetje*. Probably, loan-words such as *wigwam* 'id.' and *kampong* 'village' (Indonesian loan) can be interpreted as (prosodic) compounds, which induces secondary stress on the second syllable.

A second class of exceptions has to do with stem allomorphy: some native nouns have two allomorphs, one with a short vowel and one with a long vowel. The allomorph with the long vowel occurs in some plural forms, diminutives, and verbs, but there is no systematicity here:

(37) <i>Singular</i>	<i>Plural</i>	<i>Diminutive</i>	<i>Derived word</i>
sch[ɪ]p 'ship'	sch[e]pen	sch[e]pje	sch[ɪ]pper 'skipper'
w[ɛ]g 'road'	w[e]gen	w[ɛ]ggetje	_____
p[ɑ]d 'path'	p[a]den	p[a]dje	_____
st[ɑ]d 'city'	st[e]den	st[ɑ]dje	st[e]delijk 'urban'
b[ɑ]d 'bath'	b[a]den	b[ɑ]dje	b[a]den 'to bathe'
gl[ɑ]s 'glass'	gl[a]zen	gl[a]sje gl[ɑ]sje	gl[a]zig 'glassy'

In the case of *glasje/glaasje* we find semantic differentiation: a *glaasje* is a drinking glass or the slide used under a microscope, whereas *glasje* may refer to a spectacles lens.

Another type of stem allomorphy found with diminutives is the use of a stem without the normally occurring final stem-final schwa:

(38) karbonade 'carbonade'	karbonaadje [kɑrbonatjə]
parachute 'id.'	parachuutje [paraʃjytjə]
machine 'engine'	machientje [maʃjintjə]

Schwa deletion before *-tje* is an irregular phenomenon, and speakers might also choose not to delete the schwa. Thus, the form *parachutetje* also occurs. In most relevant words, this schwa deletion does not occur.

The type of allomorphy that we find for the diminutive suffix also occurs in de-adjectival adverbs derived with the suffix *-tjes*, which can be analysed as the morpheme sequence /tjə+s/. We get exactly the same allomorphy as for /tjə/:

(39) zacht 'soft'	zachtjes 'softly' [zɑxjəs] <sup>21</sup>
stil 'quiet'	stilletjes 'quietly' [stɪlɛtjəs]
stiekem 'stealthy'	stiekempjes 'stealthily' [stikɛmpjəs]
gewoon 'ordinary'	gewoontjes 'ordinarily' [ɣəʋontjəs]

<sup>21</sup> The /t/ is deleted due to the /t/-deletion rule to be discussed in Section 7.2.6.

Diminutive forms are also subject to P-rules. When the stem ends in a voiced obstruent, these voiced obstruents stand in syllable-final position after the application of the relevant MP-rule, for example, /hand+tjə/ becomes /handjə/ with the syllabification (hand)<sub>σ</sub>(jə)<sub>σ</sub> (/dj/ is not a possible onset). Syllable-final Devoicing will then devoice the stem-final /d/, and thus we get [hantjə] with, after resyllabification, the syllabification pattern (han)<sub>σ</sub>(tjə)<sub>σ</sub>. Another P-rule, /t/-deletion in obstruent clusters (Section 7.2.6) will delete the stem-final obstruent as in the diminutive form of the noun *kast* 'cupboard' /kast+jə/, that is realized as [kʌʃjə].

#### 4.3.2. -er-allomorphy

The suffix *-er* is used in three different functions: it forms comparative forms of adjectives, it forms subject names from verbs (cf. Booij 1986), and it forms de-nominal nouns with a variety of interpretations (cf. Booij 1988a). All three suffixes have the allomorph [dər] after a base ending in /r/, but a competing rule is that *-aar* occurs instead of *-er* in the case of the nominal (thus de-verbal and de-nominal) use of *-er*, after a base ending in schwa + coronal sonorant consonant (Smith 1976):

- |                                  |                                    |
|----------------------------------|------------------------------------|
| (40) <i>Adjective</i>            | <i>Comparative</i>                 |
| rood /rod/ 'red'                 | roder [rodər] 'redder'             |
| goochem [ɣoxəm] 'smart'          | goochemer [ɣoxəmər] 'smarter'      |
| heikel /heikəl/ 'risky'          | heikeler [heikələr] 'riskier'      |
| bitter /bitər/ 'id.'             | bitterder [bitərdər] 'more bitter' |
| zuur /zyr/ 'sour'                | zuurder [zy:rdər] 'sourer'         |
| (41) <i>Verb</i>                 | <i>De-verbal noun</i>              |
| eet /et/ 'to eat'                | eter [etər] 'eater'                |
| zeur /zør/ 'to nag'              | zeurder [zø:rdər] 'nagger'         |
| bezem /bezəm/ 'to sweep'         | bezemer [bezəmər] 'sweeper'        |
| bibber /bibər/ 'to tremble'      | bibberaar [bibəa:r] 'trembler'     |
| kibbel /kibəl/ 'to quarrel'      | kibbelaar [kibəla:r] 'quarreler'   |
| oefen /ufən/ 'to train'          | oefenaar [ufəna:r] 'trainer'       |
| (42) <i>Noun</i>                 | <i>De-nominal noun</i>             |
| Amsterdam /əmstərdəm/ 'id.'      | Amsterdammer 'inhabitant of A.'    |
| wetenschap /wetənsxap/ 'science' | wetenschapper 'scientist'          |
| Bijlmermeer /beilmərmər/ 'id.'   | Bijlmermeerder 'inhabitant of B.'  |
| Diemen /dimən/ 'id.'             | Diemenaar 'inhabitant of D.'       |
| Assen /asən/ 'id.'               | Assenaar 'inhabitant of A.'        |
| Lochem /lɔxəm/ 'id.'             | Lochemer 'inhabitant of L.'        |

These data show how Dutch avoids surfacing of the sequence [rVr], a cluster that is avoided cross-linguistically (cf. Dressler 1977, Shannon 1991). The



*-er/-aar* alternation only occurs in nouns,<sup>22</sup> whereas the *-er/-der* alternation has a general character.

The *-er/-aar* alternation can be dealt with in two ways. One analysis would simply state that these are two competing suffixes: *-aar* occurs in a specific phonological environment, *-er* is the general suffix, and occurs elsewhere (cf. Van Marle 1985 for comparable morphological analyses). However, that analysis does not account for the strong phonological similarity between *-er* and *-aar* (historically both derive from the Latin suffix *-arius*). Moreover, there are actually two nominal suffixes *-er* with different meanings, a de-verbal and a de-nominal one. So we would also have to assume two *-aar* suffixes. Therefore, I propose an MP-rule that changes *-er* into *-aar* within nouns: rule (43)

(43) *-er/-aar* rule

Insert [-high, -mid] in the context:

$[-\text{cons}]_u$	$\left[ \begin{array}{c} +\text{cons} \\ +\text{son} \\ \text{Cor} \end{array} \right]$	$[-\text{cons}]_u$	$r$	$]_N$
			—	

Since the rule inserts Place features, it will only apply to empty vowels, i.e., schwas. Thus, the second schwa will receive the Place specification of the /a/, which is the only long low vowel. Note that the rule mentions the lexical category Noun which excludes adjectives from its domain, as required. That is, it is clearly an MP-rule.<sup>23</sup>

The rule for *-der* can be seen as a P-rule since its structural description can be completely couched in phonological terms. It will insert /d/ in the sequence /r—əɾ/. It will also apply before the de-verbal suffix *-erij* /əɾci/, and insert a /d/ in, for example, *klierderij* 'nagging' from underlying /klier+əɾci/. Similarly, it applies before the suffix *-erig* as in *literairderig* 'with literary pretensions'.<sup>24</sup>

(44) /d/-insertion<sup>25</sup>

Insert /d/ in the context:  $r \text{ — } [-\text{cons}]_u r$

<sup>22</sup> The morpholexical nature of the *-er/-aar* alternation is also evident from the fact that *-aar* occurs in some words that do not completely satisfy the relevant phonological requirements, for instance *dienaar* 'servant' and *leraar* 'teacher', where the coronal consonant is preceded by a full vowel instead of the required schwa. Irregularly, *-der* occurs in *diender* 'police officer'.

<sup>23</sup> Insertion of Place features also implies removal of the diacritic [u] since syllables with *-aar* can bear (secondary) stress, as in *wāndel-àar* 'walker'.

As pointed out in Booij (1993), this rule shows that as far as Dutch is concerned coronal consonants cannot be left underspecified for [Coronal] at the level of lexical phonology, since this rule has to single out coronal consonants.

<sup>24</sup> *-erij* derived from the suffix sequence *-er-ij*, but synchronically it behaves as a suffix by itself.

<sup>25</sup> As suggested by Michael Kenstowicz (personal communication), reference to the feature [unstressable] may be avoided here by formulating the rule as follows: insert /d/ between two /r/s that are adjacent on the Place tier. Since the schwa has no Place specification, the rule will then only apply to /r/s separated by the schwa. The inserted /d/ can only be located before the [-cons] segment because otherwise the syllable-structure conditions are violated. Note that this analysis also expresses why having two /r/s is only a phonotactic problem when they are separated by schwa, and not when they are separated by a vowel with a Place specification, as in e.g. *raar* /rar/ 'strange'.

The MP-rule competes with the rule of /d/-insertion in nouns like *schipperaar* with the underlying form [ [sxɪpər]vər]<sub>N</sub>. The MP-rule has to have priority although this does not follow from the Elsewhere Principle since the class of words to which the MP-rule can apply is not completely a subset of the class of input words for the rule of /d/-insertion: the sets partially overlap. The correct ordering follows from the assumption that in the unmarked case MP-rules precede P-rules (Anderson 1974).

#### 4.4. ALLOMORPHY IN THE NON-NATIVE LEXICON

In Section 2.5.2, I introduced the rule of Learned Vowel Backing which says that in non-native suffixes mid vowels become [+back] before an adjacent non-native suffix. Crucially, this rule only applies in the non-native part of the lexicon. Before discussing a number of specific alternations in the non-native part of Dutch, I will discuss this notion 'non-native lexicon' in some more detail.

The lexicon of a language consists of at least two parts: a list of existing words, and a set of word-formation rules that serve to expand this list. In the case of Dutch, it appears that the morphological rules clearly distinguish between native and non-native input words. For instance, of the two synonymous suffixes *-iteit* '-ity' and *-heid* '-ness', the first one only attaches to non-native input words,<sup>26</sup> whereas the native (Germanic) suffix *-heid* attaches to both native and non-native input words of the required syntactic category:

- (45) absurd 'id.'                      absurditeit/absurdheid 'absurdity'  
       gewoon 'ordinary'              \*gewoniteit/gewoonheid 'ordinariness'

This asymmetry between native and non-native word formation is pervasive throughout Dutch word formation (Booij 1977: 131–9), and we may formulate the relevant morphological principle as follows:

- (46) Non-native suffixes only attach to non-native bases

The class of non-native suffixes involved comprises at least the following ones:<sup>27</sup>

- | (47) Suffix | Base word              | Derived word              |
|-------------|------------------------|---------------------------|
| -aal        | muziek 'music'         | muzikaal 'musical' (adj.) |
| -aan        | parochie 'parish'      | parochiaan 'parishioner'  |
| -aat        | doctor 'id.'           | doctoraat 'doctorate'     |
| -abel       | accept-eer 'to accept' | acceptabel 'acceptable'   |
| -age        | percent 'per cent'     | percentage 'id.'          |
| -air        | elite 'élite'          | elitair 'élitist'         |
| -andus      | doctor 'id.'           | doctorandus 'MA'          |

<sup>26</sup> Exceptions to this generalization are the words *stommateit* 'stupid act' and *flauwiteit* 'silliness'.

<sup>27</sup> Non-native prefixes are discussed in Chapter 5.

-ast	gymnasium 'id.'	gymnasiast (lit.) 'gymnasium student'
-eel	fundament 'foundation'	fundamenteel 'fundamental'
-eer	profeet 'prophet'	profeteer 'to prophesy'
-ees	Nepal 'id.'	Nepalees 'Nepalese'
-esk	ballade 'ballad'	balladesk 'ballad-like'
-ein	Rome 'id.'	Romein 'Roman'
-eur	ambassade 'embassy'	ambassadeur 'ambassador'
-eus	rancune 'rancour'	rancuneus 'vindictive'
-iaan	presbyter 'id.'	presbyteriaan 'Presbyterian'
-ica	elektron 'electron'	elektronica 'electronics'
-icus	elektron 'electron'	elektronicus 'electronic engineer'
-ide	chloor 'chlorine'	chloride 'id.'
-ieel	exponent 'id.'	exponentieel 'exponential'
-ief	agressie 'aggression'	agressief 'aggressive'
-iek	motor 'engine'	motoriek 'locomotion'
-ier	juweel 'jewel'	juwelier 'jeweller'
-ier	Israel 'id.'	Israelier 'Israeli'
-iet	metropool 'metropolis'	metropoliet 'metropolitan'
-ieus	mode 'fashion'	modieus 'fashionable'
-ine	nectar 'id.'	nectarine 'id.'
-isch	algebra 'id.'	algebraisch 'algebraic'
-iseer	banaal 'trivial'	banaliseer 'to trivialize'
-isme	absurd 'id.'	absurdisme (lit.) 'absurdism'
-ist	propaganda 'id.'	propagandist 'id.'

It is not always easy to determine whether an underived word is still felt as non-native, but morphological behaviour is a reliable indication.

So we might conceive of the non-native lexicon as a list of non-native words and a set of non-native word-formation rules. This subcomponent of the lexicon may then also comprise the MP-rules that account for the different types of allomorphy in affixes and roots. However, the notion 'non-native lexicon' cannot be seen as a completely distinct component of the grammar, because there are cases in which native affixation may take place in between cases of non-native affixation. For instance, in the word *ongrammaticaal* 'ungrammatical' the native prefix *on-* 'un-' has been added to the non-native complex adjective *grammatikaal* 'grammatical', itself derived by suffixation of *-aal* '-al' to *grammatika* 'grammar'. Yet, we can add the non-native suffix *-iteit* '-ity' to the adjective *ongrammaticaal*, because the prefix *on-* is not the head of the word. Hence, the feature [−native] percolates from the head *grammaticaal* to the whole word *ongrammaticaal* (cf. Williams 1981, Lieber 1989) which therefore allows for another cycle of non-native suffixation.

As we will see in Chapter 5, the distinction between native and non-native lexicon will also play a role in the analysis of word stress.

In the following subsections I will discuss a number of non-native MP-rules.

## 4.4.1. Affixal allomorphy

A number of non-native affixes exhibit allomorphy. They will be discussed in this subsection.

One type of allomorphy is mentioned in Section 2.2.5, the backing of long mid vowels. The following examples illustrate the working of this rule:

(48) Base word	Derived words
-eel → -aal	
fundament+eel	fundament+al+isme, fundament+al+ist
eventu+eel	eventu+al+iteit
sentiment+eel	sentiment+al+isme
ration+eel	ration+al+isme, ration+al+iteit
mor+eel	mor+al+isme, mor+al+ist
-air → -aar	
milit+air	milit+ar+isme, milit+ar+ist
vulg+air	vulg+ar+isme, vulg+ar+iseer
popul+air	popul+ar+iteit, popul+ar+iseer
-eur → -oor	
direct+eur	direct+or+aat
superi+eur	superi+or+iteit
inspect+eur	inspect+or+aat
inferi+eur	inferi+or+iteit
-eus → -oos	
nerv+eus	nerv+os+iteit
religi+eus	religi+os+iteit
curi+eus	curi+os+iteit
monstru+eus	monstru+os+iteit

Rule (49) expresses this generalization concerning non-native suffixes with mid front vowels:

- (49) Learned Vowel Backing  $\left[ \begin{smallmatrix} -\text{cons} \\ +\text{mid} \end{smallmatrix} \right] \rightarrow [+back] / - [+cons] ]_s [ \dots ]_s$

Condition:

S(uffix) = [ -native]

It is not sufficient here to assume that the rule is a cyclic rule, and hence applies in derived environments only. For instance, in *tonelist* /tonel+ist/ 'playwright' the /e/ is not backed since it is not part of a non-native suffix.

The subsequent lowering of the [+back] counterpart of /e/ and /ɛ:/ to /a/ follows from the redundancy rule that says that unrounded back vowels are low (Chapter 2, rule (15b)). The 'learned' nature of this backing rule is also evident from the fact that for most native speakers the noun derived from *nervous* 'nervous' is *nervusiteit* 'nervousness', without Learned Vowel Backing, rather than *nervositeit*.

A second type of allomorphy is characteristic for the non-native suffix *-iek* *-/ik/* that shows up as [is] before non-native suffixes that begin with an /i/ or /ɪ/:

- (50) *kathol-iek* 'catholic' /kətol-ik/, *kathol-ic-iteit* [kətolisiteit], *kathol-ic-isme* [kətolistsmə]

*sympath-iek* /sim-pat-ik/ 'sympathetic', *sympath-is-eer* [simpatise:r]

*excentr-iek* /ɛks-sɛntr-ik/ 'eccentric', *excentr-ic-iteit* [ɛksɛntrisiteit]

There are also exceptions to the rule. For instance, the final /k/ of *antiek* 'antique' does not show up as [s] before the suffix *-iteit*, but either as [k] or as [kw]: *antiquiteiten* 'antiquities' [ʌntik(w)iteitən].

The non-native suffix *-eur* that expresses agents or instruments exhibits two allomorphs before the feminizing suffix *-e*: *-eus* /øʃ/ and *-ric* /ris/ which is found in particular after stems ending in a coronal stop:

- |                                  |                       |
|----------------------------------|-----------------------|
| (51) <i>mont-eur</i> 'engineer'  | <i>mont-eus-e</i>     |
| <i>control-eur</i> 'checker'     | <i>control-eus-e</i>  |
| <i>ambassad-eur</i> 'ambassador' | <i>ambassad-ric-e</i> |
| <i>conduct-eur</i> 'conductor'   | <i>conduct-ric-e</i>  |

There are also some non-native prefixes with a specific allomorphy pattern. The negative prefix *in-*, a borrowing from Latin, still exhibits the allomorphy that it had in Latin:

- |                      |                                 |
|----------------------|---------------------------------|
| (52) <i>im-</i> [ɪm] | <i>impopulair</i> 'unpopular'   |
| <i>in-</i> [ɪn]      | <i>intolerant</i> 'id.'         |
| <i>in-</i> [ɪŋ]      | <i>inconsistent</i> 'id.'       |
| <i>il-</i> [ɪl]      | <i>illegaal</i> 'illegal'       |
| <i>ir-</i> [ɪr]      | <i>irrationeel</i> 'irrational' |

Note in particular that, whereas Dutch does have Nasal Assimilation, it does not have complete assimilation of nasals before liquids, as is the case here. The same allomorphy is shown by the prefix *con-* /kɔn/, also a Latin borrowing:

- |                        |  |
|------------------------|--|
| (53) <i>com-</i> [kɔm] | <i>commemoreren</i> 'to commemorate'       |
| <i>con-</i> [kɔn]      | <i>consistent</i> 'id.'                    |
| <i>con-</i> [kɔŋ]      | <i>conclaaf</i> 'conclave'                 |
| <i>col-</i> [kɔl]      | <i>collaboratie</i> 'collaboration' (pej.) |
| <i>cor-</i> [kɔr]      | <i>correlatie</i> 'correlation'            |

The prefixes *a-* /a/ 'id.' and *de-* /de/ 'id.' have specific allomorphs before vowel-initial stems: *an-* /aŋ/ and *des-* /dɛs/ respectively, as in *an-organisch* 'inorganic' and *des-interesse* 'disinterest'.

#### 4.4.2. Root alternations

Some non-native roots that end in /t/ alternate with either /s/ (after a consonant), or /ts/ (after a vowel):<sup>28</sup>

<sup>28</sup> Some speakers have /ts/ after a sonorant consonant, as in *tolerantie* which will then be pronounced as [toləʀantsi], but only in very careful speech, because in more casual speech /t/s tend to delete in CɪC clusters.

- |                                       |                                      |
|---------------------------------------|--------------------------------------|
| (54) akt+ie 'action' [aksɪ]           | akt+ief 'active' [aktɪf]             |
| adopt+ie 'adoption' [adɔpsi]          | adopt+eer 'to adopt' [adɔptɛ:r]      |
|                                       | adopt+ief 'adoptive' [adɔptɪf]       |
| tolerant 'tolerant' [tolərʌnt]        | tolerantie 'tolerancy' [tolərʌnsɪ]   |
| president 'id.' [presɪdnt]            | president+ieel 'presidential'        |
|                                       | [presɪdɛnsjəl]                       |
| Kant [kʌnt] 'id.'                     | Kantiaan 'Kantian' [kʌnsɪjʌn]        |
| convert+eer 'to convert'              | convers+ie 'conversion' [kɔnversɪ]   |
| [kɔnvɛrtɛ:r]                          |                                      |
| (55) rat+io 'id.' [ratsɪjɔ]           | rat+ificeer 'to ratify' [ratɪfɛsɛ:r] |
| relat+ie 'relation' [relatsɪ]         | relat+ief 'relative' [relatɪf]       |
|                                       | relat+eer 'to relate' [relatɛ:r]     |
| milit+ie 'militia' [mɪlɪtsɪ]          | milit+air 'military' [mɪlɪtɛ:r]      |
| polit+ie 'police' [polɪtsɪ]           | polit+iek 'politics' [polɪtɪk]       |
| polit+ioneel 'police-' [polɪtsɪjɔnəl] |                                      |
| stat+ion 'id.' [statsɪjɔn]            | stat+isch 'static' [statɪs]          |

The generalization is that underlying /t/ changes into /ts/ or /s/ before the morpheme /i/, or before morphemes that begin with an /i/ which is followed by a vowel in the same morpheme, as in *-io*, *-iaan*, *-ion*. The relevant rules will therefore refer to the notion 'morpheme /i/ or morpheme /i/ followed by a vowel (M = Morpheme):'<sup>29</sup>

- (56) a.  $t \rightarrow ts / [-\text{cons}] - [i \ X \dots]_M \quad X \neq [+cons]$   
 b.  $t \rightarrow s / [+cons] - [i \ X \dots]_M \quad X \neq [+cons]$

The rules will not apply to simplex words like *spaghetti* 'id.' and *Haiti* 'id.' because they do not contain a morpheme /i/. Moreover, there are also exceptions to the rule even where a nominalizing morpheme *-ie* seems to be involved as in *sympathie* 'sympathy' [sɪmpatɪ]. In the case of *Kantiaan* there is variation: it may also be pronounced as [kʌntɪjʌn]. Many speakers of Dutch realize intervocalic /ts/ as [s], for instance in *politie* which will then be pronounced as [polɪsɪ].

One may doubt whether such alternations should really be accounted for by rule. There is no transparent phonological generalization given words such as *sympathie*. Moreover, native speakers might not even establish relations between allomorphs like those of /polit/ in *polit+ie* 'police' versus *polit+iek* 'politics', given the lack of semantic relationship between these words. So we might assume that both allomorphs are listed in the lexicon as parts of the words in which they occur, and that, instead of productive rules, we have 'via rules' (Vennemann 1972) that express the systematics in the distribution of allomorphs. A via rule does not derive one form from another, but only states

<sup>29</sup> In a complete formalization of these rules, one cannot uniquely refer to /t/ as the focus of the rules if [voice] is a private feature: the rule will just refer to coronal stops. Note, however, that /d/s/ do not alternate, compare *komedie* 'comedy', *komediant* 'comedy player'. This seems to be a problem for the privative interpretation of [voice]. However, the rule has exceptions anyway (e.g. *sympathie* /sɪmpatɪ/ with the phonetic form [sɪmpatɪ]).

<sup>30</sup> The pronunciation without the velar fricative also occurs.

eléktr[ɔ]n 'id.'	elekt[r]o[n]-ica 'electronics'
álcoh[ɔ]l 'id.'	elekt[r]o[n]-icus 'electronic engineer'
	alcoh[o]l-icus 'alcoholic'
	alcoh[o]list 'alcoholic'
mót[ɔ]r 'engine'	mot[o]r-iek 'way of moving'
kán[ɔ]n 'canon'	kan[o]n-iek 'canonical'
néct[a]r 'id.'	nect[a]r-ine 'id.'
Ísra[ɛ]l 'id.'	Isra[e]l-ier 'Israeli'
Ják[ɔ]b 'Jacob'	Jak[o]b-iet 'Jacobite'
Jéz[ʏ]s 'Jesus'	Jez[y]-iet 'Jesuit'
Nó[a]ch 'Noah'	No[a]ch-iet 'Noachite'
álfab[ɛ]t 'alphabet'	alfab[e]t-isch 'alphabetic'
dém[ɔ]n 'id.'	dem[o]n-isch 'demonic'
sát[a]n 'id.'	sat[a]n-isch 'satanic'

The lengthening is triggered by [-native] suffixes, but the base should also be [-native], as is proven by the following observation. We can add the [-native] suffix *-iaan* to personal names such as the name of the Dutch linguist *Uhlenbeck* /ylənbɛk/. We then get *Uhlenbeckiaan* 'follower of Uhlenbeck', but the /ɛ/ in the final syllable is not lengthened, although it does not bear main stress: [ylənbɛkijən]. The rule should therefore be formulated as (63).<sup>31</sup>

(63) Vowel Lengthening (non-native morphemes only)<sup>32</sup>

Insert X in the context	X <sub>i</sub>	—	X	X
	[-cons]		[+cons]	[-cons]

Condition:

X<sub>i</sub> is not in a syllable with main stress<sup>33</sup>

The condition that the base-final syllable does not bear main stress explains why we do not get lengthening in the following cases, where the base word has main stress on the final syllable:

(64) Base word	Derived word
kan[ɔ]n 'gun'	kan[ɔ]nn-ier 'gun man'
kol[ɔ]s 'giant'	kol[ɔ]ss-aal 'gigantic'

<sup>31</sup> A seemingly exceptional case of lengthening is *afgodisch* [afxodis] 'idolatrous' derived from *afgod* [af-ɣɔd], [afxɔt] 'idol'. Note, however, that this may be explained by the fact that *god* is one of those native nouns that are subject to the minor rule of vowel lengthening in the native lexicon (cf. Section 4.5.1).

<sup>32</sup> The rule is not formalized as 'lengthen a vowel in an open syllable' because strictly speaking the consonant after the vowel that is going to be lengthened is ambisyllabic, hence closes the first syllable.

<sup>33</sup> This rule does not account for the concomitant raising of the /v/ of *consul* to [y] in *consulair* since the long counterpart of the /v/ is the /ø/. We might assume an underlying exceptional short /y/ for *consul*, which will then be lowered by a redundancy rule because there are no short high vowels on the surface. This lowering rule also accounts for the lowering of shortened /i/ to [ɪ] in case of vowel shortening, as in *directeur* 'director' /dɪrɛktøʀ/ [dɪrɛktø:r] (cf. Section 6.5).



mod[ɛ]l 'model'	mod[ɛ]ll-eer 'to model'
kart[ɔ]n 'cardboard'	kart[ɔ]nn-age 'cardboard manufacture'
tir[ɑ]n 'tyrant'	tir[ɑ]nn-iseer 'to tyrannize'
tromp[ɛ]t 'trumpet'	tromp[ɛ]tt-ist 'trumpeter'
klarin[ɛ]t 'clarinet'	klarin[ɛ]tt-ist 'clarinetist'

The stress condition on vowel lengthening shows that the base words must already have their stress patterns assigned before vowel lengthening applies, because after affixation the main stress will shift rightward, thus erasing the stress differences between the base words. For instance, in *alcohólicus* 'alcoholic', main stress is on the syllable (ho)<sub>σ</sub>, and this would incorrectly block lengthening if lengthening applied at the end of the derivation. Inversely, in, for example, *trompettist* the penultimate syllable is unstressed. Yet, the vowel of that syllable should not lengthen since it did have main stress on the previous cycle. In sum, the facts discussed here clearly require a cyclic application of rules: on the first cycle, stress is assigned, on the second cycle Vowel Lengthening applies, and then again the stress rule.

In Odden (1990) it is suggested that we may avoid cyclic stress assignment by making the relevant rules sensitive to lexical stresses. Indeed, words like *trompét* have exceptional stress in that normally words ending in a VC syllable do not have final stress. However, lengthening does not occur if the base word is monosyllabic, that is, in words for which the location of the main stress is completely predictable, as in *tonnage* 'number of tons' derived from *ton* 'id.', or in *blokkeer* 'to block' derived from *blok* 'block'. Another interesting case is *librettist* [librɛtɪst] 'id.' derived from *libretto* /librɛto/ 'id.'. The base word has a regular, penultimate main stress. After regular deletion of the final vowel of the base word, it is the /ɛ/ which is potentially subject to lengthening, but this is blocked by the presence of the regular main stress on the relevant syllable, as assigned on the first cycle. Thus it is correctly predicted that the /ɛ/ does not lengthen, although no lexical stress is involved here.

Non-native words in *-or* and *-on* are special in that vowel lengthening also occurs before the plural suffix *-en* /ən/ (note that normally the plural suffix after syllables without main stress is /s/):

(65) doct[ɔ]r 'id.'	doct[o]r-en 'doctors'
profess[ɔ]r 'id.'	profess[o]r-en 'professors'
juni[ɔ]r 'id.'	juni[o]r-en 'juniors'
seni[ɔ]r 'id.'	seni[o]r-en 'seniors'
mot[ɔ]r 'engine'	mot[o]r-en 'engines'
dem[ɔ]n 'id.'	dem[o]n-en 'demons'
elektr[ɔ]n 'id.'	elektr[o]n-en 'electrons'

We may also select the other plural suffix of Dutch, *-s*. In this case, the /ɔ/ is not lengthened. Also, the main stress of the word, which is on the syllable before *-or*, will then remain on that syllable, whereas it is shifted to the syllable with [o] in case the vowel is lengthened as shown in (66).

(66) dóctors	doctóren
proféssors	professóren
júniors	junióren
séniors	senióren
mótors	motóren
démons	demónen
eléktrens	elektróren

The implication of this phenomenon is that these plural forms have to be exceptionally fed back into the non-native component of the lexicon which will then make them undergo vowel lengthening and the Main Stress Rule (cf. Section 5.2). The Main Stress Rule (MSR) will then assign main stress to the syllable with the lengthened vowel (67).

(67) 1st cycle:	motɔr
MSR	ó
2nd cycle	motɔr + ən
Lengthening	o
MSR	ó
Phonetic form	[motórən]

#### 4.4.5. Other cases of allomorphy

Allomorphy in the non-native lexicon is not restricted to the alternations discussed in the preceding sections. There are more examples, which often have an unsystematic character: we simply have to learn that a specific allomorph of a word has to be used when it enters derivation. The following list of examples is by no means an exhaustive list of all the possibilities. We clearly deal here with a 'pan-European' kind of lexicon of roots, since similar alternations are found across the learned vocabularies of European languages:

(68)	<i>Base word</i>	<i>Derived word</i>
a.	orkest 'orchestra'	orkestr-eer 'to orchestrate'
b.	gymnasium 'id.'	gymnasi-ast '(lit.) gymnasium pupil'
c.	cursus 'course'	curs-ist 'student'
d.	minist[ə]r 'id.'	minist[e]r-ieel 'ministerial'
	apost[ə]l 'apostle'	apost[o]l-isch 'apostolic'
e.	g[ɛ:]ne 'shame'	g[ə]n-ant 'shaming'
f.	dimensie 'dimension'	dimension-eel 'dimensional'
	functie 'function'	function-eer 'to function'
g.	Plato 'id.'	platon-ist 'Platonist'
h.	Portugal 'id.'	Portug-ees 'Portuguese'
i.	Jezus 'Jesus'	Jezu-iet 'Jesuit'
j.	Paulus 'Paul'	Paulin-isch 'Pauline'
k.	trauma 'id.'	traumat-isch 'traumatic'
	drama 'id.'	dramat-isch 'dramatic'

horizon 'id.'	horizont-aal 'horizontal'
<i>l.</i> chaos 'id.'	chaot-isch 'chaotic'
eros 'Eros'	erot-isch 'erotic'
<i>m.</i> orgel 'organ'	organ-ist 'id.'
<i>n.</i> commiss-ie 'committee'	committ-eer 'to commit'

In some cases the allomorphy is more systematic. There are roots ending in /tr/ or /ɣl/ such as *arbiter* /arbitr/ 'id.', *center* /sentr/ 'centre', *regel* /reɣl/ 'rule', and *filter* /filtr/ 'id.' which occur without a schwa before non-native suffixes, but with a schwa in formations with a native suffix. The root ends in a cluster that cannot be syllabified because the final /r/ is more sonorous than the preceding obstruent, and thus the SSG would be violated if they formed a coda. In the non-native lexicon syllabification is made possible through attachment of a vowel-initial suffix. If no affixation takes place, the unsyllabifiable /r/ is rescued by inserting a schwa before the /r/ before the word enters the native morphology:

- (69) *arbitreer, arbitrage versus arbiter, arbiteren*  
*centreer, centraal versus center, centeren*  
*reglement versus regel, regelen, regeling*  
*filtreer, filtraat versus filter, filteren, filtering*

The rule that inserts the schwa must therefore apply after non-native morphological processes, but before the application of the native morphology:

- (70) Insert /ə/ before an extrasyllabic liquid.

Another regularity is that the stem-final vowel of words may disappear before a vowel-initial non-native suffix if that stem-final vowel is not stressed. However, this vowel deletion is not systematic:

- |                        |                           |
|------------------------|---------------------------|
| (71) Amerika 'America' | Amerik-aan 'American'     |
| Canada 'id.'           | Canad-ees 'Canadian'      |
| propaganda 'id.'       | propagand-ist 'id.'       |
| piano 'id.'            | pian-ist 'id.'            |
| cello 'id.'            | cell-ist 'id.'            |
| solo 'id.'             | sol-ist 'soloist'         |
| inflatie 'inflation'   | inflat-oir 'inflationary' |

Exceptions are words like *egoist* 'id.' and *maoist* 'Maoist'. The final vowel of the base word does not disappear if it bears the main stress of the word, as in *hobó* 'oboe'—*hoboist* 'oboist'.

In the following word pairs there is an alternation between /e/ or /ɛ/ and schwa. The underlying /e/ and /ɛ/ obligatorily change into a schwa in unstressed position:

- |                            |  |
|----------------------------|--|
| (72) juwél /jyvel/ 'jewel' | jùwel-fer [jyʋəli:r] 'jeweller'        |
| proféet /profet/ 'prophet' | pròfet-éer [prɔfəte:r] 'to prophesize' |
| arrést /urəst/ 'id.'       | àrrest-éer [urəste:r] 'to arrest'      |

This alternation is related to the phenomenon of vowel reduction (Section 6.4): vowels, and in particular the /e/ and the /ɛ/, optionally reduce to schwa in unstressed position. The difference is that in the words discussed here the reduction is obligatory. The rule can be stated as in (73).

- (73) Vowel Reduction      [ -cons ]  
                                      |  
                                      ≠  
                                      [ +mid  
                                      -round  
                                      -back ]

Condition:

In unstressed syllables only

The rule is lexically governed. For instance, in *pèrcentage* /pɛrsentaʒə/ 'id.', derived from *percént* /pɛrsɛnt/ 'per cent' the vowel of the unstressed second syllable can still be pronounced as a full [ɛ]. Optional vowel reduction is accounted for by a separate rule (cf. Section 6.4). There is also variation between speakers here: some are rather categorical in their reduction of these vowels, and thus they may have more words marked in their lexicon as subject to this rule.

Note, that, as in the case of vowel deletion, information about the stress pattern of the words involved may be crucial, either that of the base word, as in the case of vowel deletion, or that of the derived word, as in the case of vowel reduction.

It is not always clear whether the allomorphy occurs in the stem or in the suffix. In the case of *dimensioneel* one might either say that *-eel* selects a specific allomorph *dimension*, or that *dimensie* selects a specific allomorph of the suffix *-eel*, viz. *-oneel*. If the allomorphy shows up in related words with different suffixes, there is evidence that it is a case of root allomorphy. For instance, the allomorph *dramat* of *drama* 'id.' occurs in *dramatisch* 'dramatic', *dramaturg* 'dramatist' and *dramatiek* 'dramatics'. A case of allomorphy of the suffix can be seen in the word pairs *perceptie* 'perception'—*perceptueel* 'perceptual' and *contract* 'id.'—*contractueel* 'contractual', and in *exponent* 'id.'—*exponentieel* 'exponential' an allomorph with /i/ shows up. If we consider the /u/ and the /i/ part of the suffixes, we can predict the deletion of the stem-final /i/ of *perceptie*, and also the loss of the final schwa of *principe* 'principle' in the adjective *principeel* 'principled'.

Clearly, we have reached here the borders of phonology, and such observations could be relegated to morphology as well. That applies even more so in pairs of related words like the following:

- (74) plagiaat 'plagiarist'              plagieer 'plagiarize'  
       kandidaat 'candidate'          kandideer 'to nominate as candidate'

where a whole morpheme *-aat* disappears before the next suffix. Such rules have been called truncation rules by Aronoff (1976).

In sum, the non-native roots and affixes that are used in Dutch appear to have their own systematics and irregularities that do not extend to the native lexicon. The relevant rules will therefore be assigned to a specific non-native subpart of the lexical phonology of Dutch. Moreover, words will sometimes have to be listed with their specific allomorphs in the lexicon.

#### 4.5. ALLOMORPHY IN THE NATIVE LEXICON

Above, I discussed some examples of regular allomorphy in specific native suffixes. Some suffixed words exhibit allomorphy in that there is an alternation between an allomorph with initial schwa, spelled *e* and one without it. This applies to the suffixes *-ling*, *-loos*, *-lijk*, and *-nis*:

(75) twee-ling 'twins', naar-ling 'pain in the neck', verschopp-e-ling 'outcast',  
hov-e-ling 'courtier', lamm-e-ling 'dead loss', vertrouw-e-ling  
'confidant'

baan-loos 'jobless', bodem-loos 'bottomless', werk-loos 'unemployed'  
moed-e-loos 'dispirited', werk-e-loos 'idle'

aanzien-lijk 'considerable', aandoen-lijk 'moving', klaag-lijk 'plaintive'  
graf-e-lijk 'of a court', werk-e-lijk 'real', gemoed-e-lijk 'agreeable',  
vrouw-e-lijk 'female'

vuil-nis 'trash', treur-nis 'sorrow'

begrav-e-nis 'burial', laf-e-nis 'refreshment', vermoei-e-nis 'weariness'

The schwa-initial allomorph seems to be the preferred one after an obstruent, but there are no absolute rules here, as the examples *lammeling* and *werkloos* illustrate.<sup>34</sup> One may raise the question whether the schwa belongs to the suffix, or to the stem. As a matter of fact, there is evidence that the schwa should indeed be considered here an extension of the stem: *-ling* and *-loos* belong to the set of suffixes that form a prosodic word of their own, and the schwa clearly does not belong to that prosodic word, but to the preceding one. (Prosodic words cannot even be schwa-initial!) For instance, the prosodic structure of *moedeloos* '(lit.) without courage, dispirited' is ( (mu)<sub>σ</sub>(də)<sub>σ</sub> )<sub>ω</sub> ( (los)<sub>σ</sub> )<sub>ω</sub>. So these schwas might be seen as kinds of linking phonemes between stem and suffix (cf. Section 3.6 on linking phonemes).

Native roots also exhibit a number of types of allomorphy, with the common property that the relevant alternations are always lexically governed. For instance, a completely irregular pattern of vowel alternations is found for

<sup>34</sup> The phonological status of this schwa was discussed in Kooij (1977). Interestingly, Shannon (1991) argued that the insertion of a schwa after obstruents has to do with the fact that a cluster of an obstruent followed by a sonorant consonant does not form an optimal syllable contact. In optimal syllable contacts, the sonorant consonant precedes the obstruent (cf. Section 3.3.5). This also explains why it is sonorant-initial suffixes that exhibit this allomorphy.

nouns derived from strong or ablauting verbs.<sup>35</sup> Sometimes, the vowel of the de-verbal noun corresponds with one of the vowels of the verbal paradigm, but even that is not always the case, as the examples given here show:

(76) <i>Verb</i>	<i>Verbal form</i>	<i>Noun</i>
komen 'to come'	k[ɔ]m (pres. sg.)	k[ɔ]mst 'coming'
snijden 'to cut'	sn[e]d (past sg.)	sn[e]de 'cut'
sluiten 'to close'	—	slot 'lock'
ruiken 'to smell'	—	reuk 'smell'
zingen 'to sing'	—	gez[ɑ]ng 'song'
geven 'to give'	g[ɑ]f (past sg.)	g[a]ve 'gift'
	g[a]ven (past pl.)	g[ɪ]ft 'gift'

Therefore, it makes no sense to analyse such vowel alternations in terms of rules.

Another kind of irregular vowel alternation is found for a few words, where /y/ alternates with /ɔu/, as in *nu–nou* 'now', *duw–douw* 'push', and *stuw–stouw* 'to stow'. They differ in that the form with the diphthong is more informal, and may have different connotations and different conditions of use, as is particularly clear for *nu* versus *nou*.

There are also lexically governed alternations where some regularity is involved. They are discussed in the next subsections.

#### 4.5.1. Vowel lengthening

In a number of words a short vowel alternates with a long vowel, as in the following pairs of singular and plural nouns:

(77) <i>Singular</i>	<i>Plural</i>
schip 'ship' [sxɪp]	schepen [sxepən]
smid 'smith' [smɪt]	smeden [smedən]
spel 'game' [spɛl]	spelen [spelən]
weg 'road' [vɛx]	wegen [vɛɣən]
god 'god' [ɣɔt]	goden [ɣodən]
hol 'hole' [hɔl]	holen [holən]
lot 'id.' [lɔt]	loten [lotən]
hertog 'duke' [hɛrtɔx]	hertogen [hɛrtɔɣən]
dal 'valley' [dɔl]	dalen [dalən]
bad 'bath' [bat]	baden [badən]
stad 'city' [stat]	steden [stedən]

The last example is exceptional in that [ɑ] alternates with [ɛ] rather than with [a]. Note that [ɛ] is the long counterpart of both [ɪ] and [ɛ], as discussed in Section 2.5.2.

<sup>35</sup> The vowel alternations in the verbal paradigms of these strong verbs are a purely morphological matter, and will therefore not be discussed in this book.

Historically, this alternation is due to a process of open-syllable lengthening. Synchronically, however, it is a purely lexically governed phenomenon. It also occurs in other types of complex word, as in *sch[e]peling* 'crew member', *sm[e]derij* 'smithy', *l[o]terij* 'lottery', *hert[o]gelijk* 'ducal' and *st[e]delijk* 'urban'. But even for those morphemes that exhibit this alternation we also find the allomorph with the short vowel in open syllable, as in *schipper* [sxɪpər] 'skipper', *spelletje* [spɛlɛtjə] 'game', *goddelijk* [ɣɔdələk] 'divine' and *badderen* [bədərən] 'to take a bath' (informal). Inversely, we find the long vowel in all forms of the following verbs, even when the relevant syllable is closed, as is the case with the first-person singular forms:

- |                           |            |
|---------------------------|------------|
| (78) inscheep 'to embark' | /ɪnsxep/   |
| smeed 'to forge'          | /smed/     |
| speel 'to play'           | /spel/     |
| verafgood 'to idolize'    | /vɛrɒfɣod/ |
| loot 'to cast lots'       | /lot/      |
| daal 'to go down'         | /dal/      |
| baad 'to take a bath'     | /bad/      |

The long vowel is also found in a closed syllable in a compound like *scheepsbeschuit* '(lit.) ship's biscuit'.<sup>36</sup>

#### 4.5.2. /də/-Ø alternations and /ə/-Ø alternations

In medieval Dutch a phonological process took place in which the sequence /də/ was deleted both word-finally and in intervocalic position. It was a process subject to lexical diffusion, that is, it affected a number of words, one by one, and then it stopped. Consequently, there are a number of words in Dutch with two forms, one with, and one without /də/. As may be expected, the two allomorphs often got different meanings, or at least a stylistic differentiation (the *de*-less allomorph is more informal, or the allomorph with *de* archaic):

- |                          |                              |
|--------------------------|------------------------------|
| (79) <i>Word-finally</i> |                              |
| sneede 'cut'             | snee 'cut, slice (of bread)' |
| armoede 'poverty'        | armoe                        |
| lade 'drawer'            | la                           |
| weide 'meadow'           | wei                          |
| koude 'cold'             | kou                          |
| heide 'heath'            | hei                          |
| moede 'tired'            | moe                          |
| mede 'with'              | mee                          |
| zeide 'said'             | zei                          |

<sup>36</sup> These alternations are discussed in Zonneveld (1978) where a so-called abstract analysis of them is given, and in Booij (1981a: 69–72) who argues against the abstract analysis.

*Intervocally*

broeder 'brother'	broer
moeder 'mother'	moer 'female animal, female screw'
ijdel 'vain'	ijl 'thin'
buidel 'pouch'	buil 'lump'
voeder 'animal food'	voer
neder 'down'	neer

More examples are given in Zonneveld (1978: 73–86). An example of a resulting meaning difference is the case of *broeder*, a word that can also be used for someone in a religious order, for a male nurse, and as a form of address in church meetings, versus *broer* that can only be used in its literal meaning 'brother'. One even gets subtle meaning differences in verbs derived from these nouns. For instance, the verb *voeren* 'to feed' can be used for referring to the feeding of both animals and children, whereas *voederen* can only refer to the feeding of animals. In complex words, usually only one of the allomorphs is correct: we do not find *heiveld*, only *heideveld* 'heath', nor *broertwist* besides the correct *broedertwist* 'row between brothers'.

The phonological generalization that can be made is that *de* deletes after long vowels and diphthongs, in word-final position, or before /g, k, m, l, r/ (Zonneveld 1978: 73). However, it will be clear that this generalization can only be seen as a *via* rule. Moreover, the process only affected native words: words of Romance origin do not alternate.

Another phonological process that was active in medieval Dutch is word-final schwa deletion after a voiced coronal obstruent, which resulted in word pairs like the following:

(80) einde 'end'	eind
stonde 'hour'	stond
aarde 'earth'	aard
gaarde 'garden'	gaard
keuze 'choice'	keus
wijze 'manner'	wijs
leuze 'slogan'	leus

Since this process was also subject to lexical diffusion, that is, affected words on a word-by-word basis, there are regions of Dutch where the schwa-deletion rule affected a word before *de*-deletion, thus bleeding the latter rule. For instance, in North Holland, *weide* became *weid*, a form to which *de*-deletion does not apply, whereas in standard Dutch the form *wei* occurs (cf. Verhoeven 1974).

Schwa deletion also occurs before the adjectival suffix *-s*, and in compounds at the end of the first prosodic word (Van Marle 1982). The absence of the schwa is lexicalized in the case of compounds:

(81) aarde 'earth'	aards 'earthly'
Drente 'id.'	Drents 'of Drente'
(geographical name)	



Suriname 'Surinam'	Surinaams 'Surinamese'
aard(e) 'earth'	aard-appel 'potato' (*aarde-appel)
	aard-beving 'earthquake' (*aarde-beving)
	aard-bei 'strawberry' (*aarde-bei)
eind(e) 'end'	eind-verslag 'final report' (*einde-verslag)
schande 'shame'	schand-knaap 'catamite' (*schande-knaap)
	schand-paal 'pillory' (*schande-paal)
	schand-vlek 'blot' (*schande-vlek)

#### 4.5.3. /d/-deletion and /d/-weakening

In a number of words, the underlying /d/ optionally alternates with [j] or [v], before a schwa, which is usually either an inflectional suffix or the first segment of a derivational suffix.<sup>37</sup> The form with the glide has a more informal character:

- (82) a. breed /bred/ 'wide'      bred+e [brejə] 'wide' (attr.)  
           rood /rod/ 'red'          rod+e [rojə] 'red' (attr.)  
           goed /ɣud/ 'good'        goed+e [ɣujə] 'good' (attr.)  
    goed+ig [ɣujəx] 'complacent'
- b. goud /ɣɔud/ 'gold'        goud+en [ɣɔuvən] 'golden'  
           oud /ɔud/ 'old'            oud+e [ɔuvə] 'old' (attr.)

These alternations are lexically governed. For instance, it is impossible to pronounce *hoeden* 'hats' /hud+ən/ as [hujən], and in standard Dutch the phonetic realization [ɔuvərs] for *ouders* 'parents' /ɔud+ər+s/ is also impossible, even though the morpheme *oud* 'old' does exhibit this alternation in the inflected form *oude*.<sup>38</sup> The same applies to *ouderling* 'presbyter', whereas, on the other hand, the form with [v] is the only possible form in *ouwehoeren* 'to nag' (from *ouwe hoer* '(lit.) old whore, nagger', where, again, *ouwe* is the only possible form: *oude hoer* is only possible in the literal interpretation 'old whore'). These facts show that, although certain phonological generalizations can be made, yet all the allomorphs have to be listed in the lexicon, and complex words will be entered in the lexicon with the one or two allomorphs that they allow for. This is reflected by the fact that in Dutch orthography the occurrence of the glide in cases like *ouwe* is represented in the spelling.

In the case of morphemes with a front vowel or a diphthong the glide that is created is homorganic with the preceding vowel. Morphemes with back vowels are different in that they have /j/ rather than the homorganic glide /v/. I will therefore assume that the /d/ alternates with /j/ after steady-state vowels, and

<sup>37</sup> An exception is *beneden* 'down' with the allomorph [bənejən] for which there is no evidence for internal morphological structure.

<sup>38</sup> Zonneveld (1978). Some dialects of Dutch, particularly in the south-western part of Holland, allow for considerably more cases of /d/-weakening, cf. Zonneveld (1978).

(83) *a.*  $d \rightarrow j$  / **X X**

$$\begin{array}{c} | \\ [-\text{cons}] \quad - \quad [-\text{cons}] \end{array}$$
$$b, d \rightarrow \emptyset / X \quad X$$
$$\begin{array}{ccc} | & | & \\ [-\text{cons}] & [-\text{cons}] & - \quad [-\text{cons}] \end{array}$$

(84) glijd 'glide' /gleid/      glij  
rijd 'ride' /reid/      rij  
snijd 'cut' /sneid/      snij  
houd 'keep' /houd/      hou  
lijden 'suffer' /leid/      lij

(85)  $d \rightarrow \emptyset / X \quad X \rightarrow ]_v$

$$\begin{array}{cc} | & | \\ [-\text{cons}] & [-\text{cons}] \end{array}$$

(86) <i>Present</i>	<i>Past singular</i>	<i>Past plural</i>
glijd/glij	gleed/glee	gleden/gleeën [glejən]
rijd/rij	reed/ree	reden/reeën [rejən]
snijd/snij	sneed/snee	sneden/sneeën [snejən]

<sup>39</sup> Zonneveld (1978: 32) presents a slightly different analysis in that he assumes that /d/ also deletes after front vowels, as in *reden/freeën* 'ride' (past pl.). In my analysis a form like *ree* is derived from the *d*-less verbal allomorph *rij* 'ride' (pres.). The latter form is derived by a separate rule for verbs ending in diphthong + /d/.

verbs, we predict that they will also have two past-tense allomorphs, and that we only find /j/ instead of /d/ in past-tense forms if the correlating present-tense stem allows for /d/-deletion. This is a correct prediction. For instance, since *belijden* 'to confess' has no /d/-deletion, the past tense plural form *beleden* cannot be realized as [bølejən], and this is a systematic pattern for these verbs. Similarly, although we have *rijer* 'rider' derived from the allomorph *rij* 'to ride', we do not have *belijer* 'confessor' alongside with *belijder* because the verb *belijden* does not have the allomorph *belij*.<sup>40</sup>

#### 4.5.4. Ø-/k/ alternations

In a number of words the morpheme-final /ŋ/ alternates with the cluster /ŋk/ (Booij 1980, Trommelen 1984):

(87) oorspro[ŋ] 'origin'	oorspro[ŋ]k+elijk 'original'
toega[ŋ] 'access'	toega[ŋ]k+elijk 'accessible'
aanva[ŋ] 'start'	aanva[ŋ]k+elijk 'initial'
jo[ŋ] 'young'	jo[ŋ]kvrouw 'damsel'
spri[ŋ] 'to jump'	spri[ŋ]khaan 'grasshopper'
la[ŋ] 'long'	la[ŋ]kmoedig 'long-suffering'

The historical background of this alternation is that the morpheme-final nasal derives from the sequence /ŋg/. The /g/ devoiced in certain positions, among others at the end of a syllable (the rule of Syllable-final Devoicing), as illustrated by *jonkvrouw* with the structure [ [jong]<sub>A</sub>[vrouw]<sub>N</sub> ]<sub>N</sub> '(lit.) young woman'.<sup>41</sup> Later, the velar plosive /g/ developed into a velar fricative, and was dropped after nasals because Dutch does not allow for codas with nasal + fricative. Such clusters only occur as heterosyllabic clusters as in *fungeren* /fʏŋɣerən/ 'to function'. Synchronically, we have to list words with the allomorph ending in [k] in the lexicon, because we also find cases where the [k] does not show up in exactly the same environment:

(88) jong [jɔŋ] 'young'	jongvee [jɔŋve] 'young cattle'
bang [bɑŋ] 'afraid'	bangelijk [bɑŋəlɛk] 'fearful'
spring [sprɪŋ] 'to jump'	springnet [sprɪŋnɛt] '(lit.) jumping net'

In other words, the alternation is not productive any more.

#### 4.5.5. Fricative devoicing

As pointed out in Booij (1977: 87) the final fricatives of native morphemes devoice before the schwa-initial suffixes *-elijk* and *-enis*. Since these fricatives

<sup>40</sup> The past-tense forms of *zullen* 'will' are irregular in that the sg. form is always without /d/ (*zou*), whereas the plural has both forms, *zouden* and *zouwen* [zɔuvən]. Compare also *kon* 'could' (sg.) with *konden* 'could' (pl.), with the same type of irregularity.

<sup>41</sup> The devoicing of obstruents before *-elijk* will be discussed in the next subsection.

will occur in onset position this devoicing cannot be related to the automatic P-rule of Syllable-final Devoicing. Moreover, the devoicing is very restricted: it applies to labial and coronal fricatives before *-elijk*, and to labial fricatives before *-enis*:

- |   |  |
|---|--|
| <p>(89) a. graaf /grav/ 'earl'<br/>         lijf /leiv/ 'body'<br/>         vrees /vrez/ 'fear'<br/> <br/>         begraaft /bəɣrav/ 'to bury'<br/>         droef /druv/ 'sad'<br/>         laaf /lav/ 'feed'</p> | <p>gra[f]lelijk 'of a court'<br/>         lij[f]lelijk 'bodily'<br/>         vre[s]lelijk 'horrible'<br/> <br/>         begra[f]lenis 'burial'<br/>         droe[f]lenis 'sadness'<br/>         la[f]lenis 'refreshment'</p> |
| <p>compare:</p>   |  |
| <p>b. heb /hɛb/ 'to have'<br/>         land /lɒnd/ 'land'<br/>         besnijdt /bəsnɛɪd/ 'to circumcise'<br/>         verrijst /vɛrreɪz/ 'to rise'</p>   | <p>onhe[b]lelijk 'rude'<br/>         lan[d]lelijk 'rural'<br/>         besnij[d]lenis 'circumcision'<br/>         verrij[z]lenis 'resurrection'</p>  |

The generalizations involved are expressed by the MP-rules (90a, b).

- |  |   |
|--|---|
| <p>(90) a. <math>\begin{bmatrix} -\text{cons} \\ +\text{cont} \\ \text{Lab} \end{bmatrix}</math></p> <p style="text-align: center;"> </p> <p style="text-align: center;">=</p> <p style="text-align: center;"> </p> <p>[+voice] / — ələk, ənis</p> | <p>b. <math>\begin{bmatrix} -\text{cons} \\ +\text{cont} \\ \text{Cor} \end{bmatrix}</math></p> <p style="text-align: center;"> </p> <p style="text-align: center;">=</p> <p style="text-align: center;"> </p> <p>[+voice] / — ələk</p> |
|--|---|

#### 4.6. ALLOPHONIC RULES

Allophonic rules differ from the automatic P-rules discussed above in that they do not involve alternations between segments that occur in lexical, that is, underlying, forms. They have the same property of being determined by phonological conditions only.

An allophonic rule that was already mentioned in Section 2.2.1 is the rule that lengthens long vowels before /r/. It is a rule that applies obligatorily, within the domain of the prosodic word. The effect of the rule is shown below (cf. Streeksra and De Graaf 1979):

- |                      |            |               |          |
|----------------------|------------|---------------|----------|
| (91) koraal 'choral' | [ko:ral]   |               |          |
| Erik 'id.'           | [e:ɾɪk]    |               |          |
| oregano 'id.'        | [o:reɣano] |               |          |
| pirouet 'pirouette'  | [pi:ruvɛt] |               |          |
| uur 'hour'           | [y:r]      |               |          |
| boer 'farmer'        | [bu:ɾ]     | boer+en (pl.) | [bu:ɾən] |
| boor 'drill'         | [bo:ɾ]     | bor+en (pl.)  | [bo:ɾən] |

kaars 'candle'	[ka:rs]	kaars+en (pl.)	[ka:rsən]
toorn 'rage'	[to:rn]	toorn+en 'to rage'	[to:rnən]
koers 'direction'	[ku:rs]	koers+en 'to direct'	[ku:rsən]

Lengthening does not apply in the past-tense forms of some strong verbs that have exceptional rhymes in which a long vowel is followed by two (non-appendix) consonants in the coda, as in *zwierf* [zwɪrf] 'wandered', *wierp* [vɪrp] 'threw', *bedierf* [bədɪrf] 'spoiled', *verwierf* [vɛrvɪrf] 'acquired', and *stierf* [stɪrf] 'died'. These facts are accounted for if we assume that the underlying vowel of these forms is /ɪ/ rather than /i/, which is then turned into [i] after lengthening of long vowels before /r/. This solution is possible because we do not find combinations of /ɪ/ and /rp/ or /rf/ at the underlying level. Moreover, it explains why at the surface these syllables can violate the Maximal Rhyme Constraint. Lengthening in these exceptional morphemes is also impossible in plural forms, where the /r/ is syllable-final:

(92) <i>zwierven</i>	[zvɪrvən]
<i>wierpen</i>	[vɪrpən]
<i>bedierven</i>	[bədɪrvən]
<i>verwierven</i>	[vɛrvɪrvən]
<i>stierven</i>	[stɪrvən]

In compounds in which the second constituent begins with an /r/, this /r/ cannot have a lengthening effect because it does not belong to the same prosodic word. This explains the contrast in the realization of vowels in pairs of words like the following:

(93) <i>keur</i> 'to select' [kø:r]	<i>keur-ing</i> 'selection' [kø:rɪŋ]
versus	
<i>keu-ring</i> 'pig's 'ring'	morphological structure [keu] <sub>N</sub> [rɪŋ] <sub>N</sub> <sub>N</sub>
	phonetic form [kø:rɪŋ]

Lengthening also applies to the vowel of the non-native suffix *-eur*, as in *direct+eur* 'director' [di:rɛktø:r]. However, in the suffix sequence *-eus-e* derived from *-eur-e* the vowel is not lengthened. This confirms that lengthening is a word-level P-rule: if it were a cyclic rule we would get a lengthened /ø:/ in the sequence *-euse*. In sum, the lengthening rule must be considered a word-level rule that applies in the domain of the prosodic word.<sup>42</sup> Its post-

<sup>42</sup> This rule is a lexical rule since it is an obligatory rule of word phonology. Thus, it forms a problem for the hypothesis that lexical rules are structure preserving (Kiparsky 1985), i.e., that they do not create new types of segment, but only segments which occur at the underlying level. A similar problem was noted for German by Hall (1989): the allophonic rule that accounts for the occurrence of the palatal allophone [ç] and the velar allophone [x] of the palatal/alveolar fricative after front and back vowels respectively, is also a lexical rule. The same point (the existence of non-structure-preserving lexical rules) is made by Harris (1987, 1989). As proposed by Booij and Rubach (1987) and supported by Iverson and Salmons (1992) who point out that the German rule is a word-level rule as well, the hypothesis of structure-preservingness should be restricted to the cyclic rules, i.e., word-level rules need not be structure-preserving. Thus, the rule of vowel lengthening discussed here does not form a problem for the theory since it is a word-level rule.

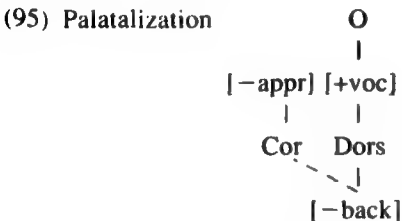
cyclic (word-level) nature follows from the fact that the sequence long vowel + /r/ never forms a derived environment.

A second allophonic rule is the rule that palatalizes the coronal obstruents and nasals /s, z, t, n/ before /j/. This kind of palatalization is the shift of the primary place of articulation, not the addition of a second place of articulation:

(94) katje 'kitten'	[kʌtʃə]
tasje 'little bag'	[tʌfʃə]
jury 'id.'	[ʒjy:ri]
sjaal 'shawl'	[ʃʃal]
atjar 'id.'	[ʌtʃər]
pasja 'pasha'	[pʌʃʃa]

In the case of *handje* 'hand' (dim.) we even get double palatalization: [hʌŋtʃə] (or [hʌŋcə]). This example shows that palatalization also affects the /n/. Note that while the /j/ is considered to be [Dorsal], the palatalized coronals are usually considered to be [Coronal, -anterior], that is, postalveolars.

Palatalization should be expressed as a spreading rule. Sagey (1986: 108–9), who discusses the same rule for English, interprets this process as a rule that spreads [–back] to the Coronal node, with the concomitant effect that the Coronal node is specified as [–anterior] (underlyingly, there is no specification for [anterior] in Dutch). The rule is given in (95).



The rule applies obligatorily within prosodic words, and optionally across prosodic word boundaries.<sup>43</sup>

<sup>43</sup> An alternative and simpler analysis of palatalization is presented in Lahiri and Evers (1991) who argue that the /j/ and the front vowels have the Place node [Coronal, –anterior], and that palatalization is spreading of this Place node. In this way, palatalization can be expressed more directly as spreading of the Articulator node. The same point is made in Clements and Hume (1993). Jacobs and Van de Weijer (1992) proposed that the /j/ has a Place node that dominates both [Coronal, –anterior] and [Dorsal, –back], and that this Place node is spread to the preceding coronal consonant. A similar position is advocated by Pulleyblank (1989).

Lahiri and Evers (1991: 99) also point out that there is variation between speakers as to the phonetic realization of the /tj/-sequence in diminutive suffixes. Whereas in my dialect it is indeed a palatalized /t/: [tʃ], some speakers realize this sequence more like [tsʃ].

## WORD STRESS

### 5.1. INTRODUCTION

Dutch is a language with word stress. That is, one of the syllables of a word is perceived as the prominent one, the main stress of the word. In words with more than one syllable, other syllables may also have stress, of a lower degree, so-called secondary stress.

The phoneticians Cohen, 't Hart, and Collier have shown that main stress is realized as a pitch movement on the relevant syllable, if the word in question bears a sentence accent.<sup>1</sup> In other words, a syllable with main stress is a potential locus of sentence accent. A pitch rise in the most prominent syllable of a word will give a sentence accent to that word if the pitch rise starts before the vocalic part of the syllable. Pitch lowering assigns accent if the lowering starts after the beginning of the vocalic part of the stressed syllable. In other words, it is the timing of the pitch movement that is crucial. Thus we get intonational patterns like the following, the so-called hat pattern which is

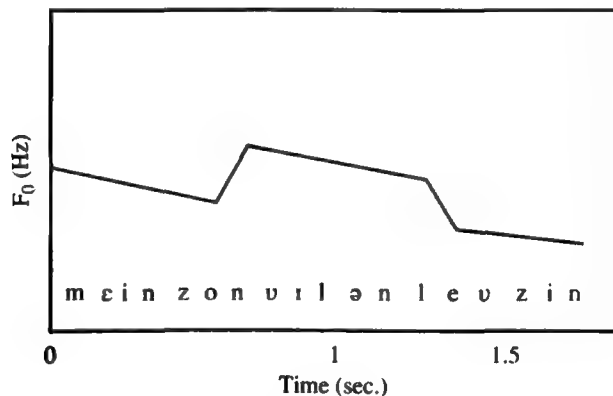


FIG. 5.1. Stylized pitch contour of the sentence *Mijn zoon wil een leeuw zien* 'My son wants to see a lion'

Source: Based on Nootboom and Cohen (1976: 151)

<sup>1</sup> Cf. Cohen and 't Hart (1967), 't Hart and Cohen (1973), 't Hart and Collier (1975), Collier and 't Hart (1981), Nootboom and Cohen (1976), 't Hart, Collier, and Cohen (1990).

frequent in Dutch (Nootboom and Cohen 1984: 156–7), with two accent assigning pitch movements (Fig. 5.1).

The accents are realized as pitch accents that consist of movements with respect to the low and the high declination line for  $F_0$ , the fundamental frequency.

This does not mean that stress is to be equated with pitch movement. Stress is a more abstract property, which also manifests itself in vowel duration and (lack of) vowel reduction, and these phenomena also play a role in the perception of syllables as being stressed (Beckman 1986). Note also that the location of stress plays a role in some morphological rules and lexical phonological rules, that is, at a level where pitch movements are not available yet.

Moreover, a pitch accent can also be placed on a syllable without lexical stress, for instance for metalinguistic reasons, as in *Heb je versie of verbúm gezegd?* 'Did you say *versie* ('version') or *verbúm* ('verb')?'<sup>2</sup> (The words *versie* and *verbum* have lexical stress on the first syllable.)

In recent years some phonologists have argued, also with respect to Dutch, that sentence stresses should not be seen as pitch movements imposed on the basic declination line, but as tone elements (High or Low) associated with the syllables that bear sentence stress, with predictable tone contours between the sentence stresses.<sup>3</sup> This approach maintains the insight that sentence stress is related to pitch movement.

Secondary stress is determined by a rhythmic principle, that is, it creates an alternation of stressed and unstressed syllables. For instance, in the word *automaat* 'automaton', main or primary stress falls on the final syllable, and secondary stress on the first syllable, whereas in *dominee* 'parson' we find the reversed stress pattern.

Both primary and secondary stress have a potential effect on duration. For instance, in a pair like *bactérie* 'bacterium'–*difterie* 'diphtheria' the identical second syllables (te)<sub>σ</sub> differ in duration because this syllable only bears primary stress in the first word. And when *automaat* /ʔutomat/ is pronounced in isolation, the syllable (mat)<sub>σ</sub> has the longest duration, the unstressed syllable (to)<sub>σ</sub> is the shortest, and the duration of the secondary stressed syllable is in between that of the other two (Nootboom 1972, Sloodweg 1988) which shows that secondary stress also has effect on duration.<sup>4</sup> The imposed stress pattern also has an effect on the possibility of vowel reduction: only unstressed vowels can be reduced to schwa. That is, only the /o/ of (to)<sub>σ</sub> can be reduced to a

<sup>2</sup> Example from Sluijter (1992).

<sup>3</sup> Cf. Gussenhoven (1984, 1988, 1991), Ladd (1992) and the references given there, and Van den Berg, Gussenhoven, and Rietveld (1992). Critical comments on this view are given in Collier (1989).

<sup>4</sup> The duration of a syllable also depends on its position in the word. As Sloodweg (1988: 14) points out, '[T]he duration of the unstressed final syllable is nearly as long as the duration of a stressed one in the same position.' In other words, the final syllable of *automaat* would have a long duration anyway, even if it were unstressed.



schwa, resulting in the phonetic form [ɔutəmat]. Secondary stress also plays a role in determining the place to which a stress is moved in case of stress shift, as will be illustrated below.<sup>5</sup>

Following Liberman and Prince (1977), Prince (1983), Selkirk (1984*b*), and Halle and Vergnaud (1987) I will represent the stress pattern of a word by means of a grid.<sup>6</sup> Each syllable has an entry on line 0 of the grid, indicated by '-', the place holder of the syllable on the grid. Each syllable with stress will get an asterisk (\*) on line 1, the foot level, where metrical feet will be created. The optimal Dutch foot consists of a stressed syllable, followed by an unstressed one. On the next level, line 2, the word level, the syllable with main stress will have an entry. This also applies to monosyllabic words. In other words, the degree of stress is indicated by the number of asterisks that a syllable has on the grid. So the stress representation for the words *automaat* and *dominee* will be as follows:

(1)	au	to	maat	do	mi	nee	
	-	-	-	-	-	-	line 0
	(*	)	(*)	(*	)	(*)	line 1
			*	*			line 2

The parentheses indicate that a stressed syllable (a 'peak') forms a constituent (a foot) with a following unstressed syllable (a 'trough') if possible. For convenience's sake, I will usually omit line 0 in the stress representations, and also the parentheses that indicate constituency, unless it is crucial for the analysis.

In compounds, each prosodic word has a stress grid. In Dutch compounds, the primarily stressed syllable of the first constituent becomes the main stressed syllable of the whole compound. So we add an asterisk for that syllable on the next level, line 3, as illustrated for the compound *dorpsdominee* 'village parson, rector':

(2)	dorps	do	mi	nee	
	*                  *		*		line 1
	*                  *				line 2
	*				line 3

<sup>5</sup> The relation between accent and duration in Dutch is also dealt with in Eefting (1991) and Sluijter (1992).

<sup>6</sup> Kager (1989) also uses the grid for the representation of the stress patterns of Dutch words, whereas Trommelen and Zonneveld (1989*a*) use metrical trees in their study of Dutch stress, following Hayes (1981). My use of grids is not to be taken as to imply necessarily the claim that metrical grids are superior to metrical trees. In the Hayesian approach feet, on which strong-weak relations between syllables are defined, form a prosodic category in between syllables and prosodic words. Below, occasional evidence for the prosodic category 'foot' in Dutch outside the area of stress will be mentioned. Evidence for the foot as a domain of phonological rules has been provided for a number of languages (cf. Poser (1990), Itô and Mester (1992) for Japanese, McCarthy and Prince (1990) for Arabic).

This gives rise to a so-called stress clash, a clash between two adjacent stresses. A situation of stress clash is defined as a situation in which two asterisks are adjacent at two consecutive levels (Lieberman and Prince 1977). It is indicated here by the boxed part of the representation. The only way to remedy this is to shift the line-2 asterisk of the syllable (do)<sub>σ</sub> to the last syllable. We cannot shift the asterisk to the syllable (mi)<sub>σ</sub> because a well-formedness condition on grids is that a syllable that has an asterisk at line  $n$ , also has to have an asterisk at line  $n - 1$  (Prince 1983). Also, we cannot move the line-3 asterisk to the syllable (do)<sub>σ</sub> because in that case the stress clash still exists. So, the stress clash is resolved by the operation Move \*, with the following effect (called Trochaic Reversal):

*Trochaic Reversal*

(3)	dorps	do	mi	nee	
	*	*		*	line 1
	*			*	line 2
	*				line 3

In Section 5.2. I will discuss the stress patterns of underived words and non-native complex words. The subsequent sections deal with the stress patterns of the different categories of morphologically complex words.

## 5.2. MAIN STRESS PATTERNS

There are two general principles for the distribution of stresses (primary or secondary) in all Dutch words:

(4) Schwa Restriction

A syllable headed by a schwa never receives stress.

(5) Optimal Grid Principle

A prosodic word has an alternating stress pattern.

Principle (4) restricts principle (5). For instance, in the word *sappelen* /səpələn/ 'to toil', a stressed syllable is followed by two unstressed syllables: the final syllable cannot get the stress that would give the word an alternating pattern, because it contains a schwa. In formal terms, the Schwa Restriction means that only a syllable with a nucleus that has a Place specification can receive an entry on line 1.

Let us now look in more detail at the location of primary stress in underived words. From the historical point of view, Dutch stress is a mixture of three patterns (Van Marle 1980): a Germanic pattern, with stress on the initial stressable syllable, a French pattern with stress on the final stressable syllable, and a Latin pattern with stress on the penultimate syllable, or on the antepenultimate if the penultimate is light (i.e. the rhyme of the penultimate consists of a short vowel):

- (6) *German*: pĭjler /pɛilər/ 'pillar', bevél /bəvɛl/ 'command'  
*French*: kanón /kanɔn/ 'gun', paráde /paradə/ 'id.'  
*Latin*: kánon /kanɔn/ 'canon', válĭum /valiym/ 'id.'

This does not mean that stress is completely unpredictable from the synchronic point of view. Minimal pairs are scarce: *kanón* 'gun' v. *kánon* 'canon', and *servĭes* [servis] 'dinner service' v. *Sérvisch* [servis] 'Serbian'. The position of stress often correlates with segmental structure, as illustrated by the etymologically related pair of words *piláar* /pilar/ 'pillar'–*pĭjler* /pɛilər/ 'pillar'. In *pilaar* we have the French stress pattern, whereas in *pĭjler* we see the Germanic stress pattern: in Germanic, stress shifted to the first syllable. This led to reduction of the second syllable in that its vowel changed into a schwa. Moreover, stressed /i/ diphthongized, changing /i/ into /ɛi/. Put more generally: since the words in the different layers of the vocabulary exhibit partially different patterns of segmental composition, it is possible to formulate generalizations concerning the locus of main stress on the basis of segmental composition. However, many cases of unpredictable stress will remain. For instance, words ending in *-ie* have main stress on the penultimate syllable, on the antepenultimate syllable, or on the final syllable (words of French origin); compare:

- (7) a. ólie /oli/ 'oil'  
       kanárie /kanari/ 'canary'  
       Hérri /hɛri/ 'id.' (female name)  
       bikíni /bikini/ 'id.'  
    b. álibi /alibi/ 'id.'  
       Rímini /rimini/ 'id.'  
    c. melodíe /melodi/ 'melody'  
       chemíe /xemi/ 'chemistry'  
       energíe /enɛrzji/ 'energy'  
       Soffe /sofi/ 'Sophie'

The regularities that are discussed here, appear to hold for both underived words and complex words derived by non-native morphology, but there are more exceptions in the subset of native underived words. The Main Stress Rule proposed here is a rule that looks at the last three syllables of a word, that is, it applies from right to left. The basic generalizations can be found in Van der Hulst (1984), Trommelen and Zonneveld (1989a), and Kager (1989), the latest in-depth studies of Dutch word stress.<sup>7</sup> They can be summarized as follows:

- (8) *Words ending in a vowel*: penultimate stress: ólie 'oil', kanárie 'canary', etc., with two classes of exceptions:  
    (a) some words have antepenultimate stress, for example, words in *-ia*, *-io*: ária 'id.', rátio 'id.', etc.

<sup>7</sup> Kager (1989) provides an excellent survey of the descriptive generalizations concerning the stress patterns of underived and non-native words ('level-1 stress'), with a wealth of examples, and also gives a critical summary of the theoretical literature on Dutch word stress before 1989. I will not give the (long) list of references here since they can be found in Kager's book.

(b) some words have final stress: *melodíe* 'melody', *trofée* 'trophy', *kadó* 'gift', etc.

- (9) *Words ending in long vowel + consonant (VVC), short vowel + CC (VCC), or a diphthong (+ optional C):* final stress: *kanáal* 'channel', *perkamént* 'parchment', *kopíj* 'manuscript', *paradíjs* 'paradise'. Exceptionally, main stress may be located on a penultimate or antepenultimate syllable, subject to the following restriction: primary stress cannot be on the antepenultimate syllable if the penultimate is closed or contains a diphthong (Kager 1989: 227): *líchaam* 'body', *hóspitaal* 'hospital', *andíjvie* 'endive', *índex* 'id.', *ólifant* 'elephant', *appéndix* 'id.', *júffrouw* 'miss', *sélderij* 'celery'.
- (10) *Words ending in short vowel + consonant (VC):* stress on the penultimate or antepenultimate syllable. Stress cannot fall on the antepenultimate syllable if the penultimate is closed or contains a diphthong: *mólton* 'soft sheet', *léxicon* 'id.', *eléktron* 'id.'. Exceptionally, stress may fall on the final syllable, as in *balkón* 'balcony', *japón* 'dress', *kanón* 'gun'.

Based on these stress patterns we may formulate the following Main Stress Rule for Dutch that has the last two (in case of extrametricality, three) syllables of the word as its 'window':

- (11) Main Stress Rule (MSR)
- Create a left-dominant foot (\* -) in the domain of the prosodic word, from right to left, in which the trough (-) does not dominate closed syllables or diphthongs. Otherwise, create a monosyllabic foot (\*);<sup>8</sup>
  - Add an asterisk on line 2.

The function of the extra asterisk at line 2 is to make it possible to distinguish the main stress from the secondary stresses. The distribution of the latter are not determined by segmental information, but only by rhythmic principles that apply to every prosodic word of Dutch. The line-2 asterisk can only be inserted under a line-1 asterisk due to the well-formedness constraint introduced above.

The working of the MSR is illustrated by the following words:

(12)	<i>olie</i>	<i>andijvie</i>	<i>kanaal</i>	<i>perkament</i>	<i>kopij</i>
	*	*	*	*	*
	*	*	*	*	*

<sup>8</sup> Kager (1989) interprets the constraint that the weak syllable of a foot cannot contain a diphthong or a closed syllable as a case of syllable weight. Following Lahiri and Kooreman (1988) he argues that since Dutch does not allow for mono-positional rhymes, weight distinctions cannot function at the level of syllable structure, and the weight distinction in Dutch is taken over by the melodic tier: long vowels are melodically simplex, diphthongs and closed syllables are melodically complex. However, this goes against the established implicational universal that if in a language VC syllables count as heavy, VV syllables also count as heavy (Zec 1988). Moreover, there is no evidence that weight plays a role in secondary stress assignment. Therefore, I do not give a weight interpretation to the MSR: it only establishes a correlation between main-stress locus and segmental make-up of words and syllables.

In order to derive the other patterns, we have to make use of the notion 'extrametricality': a word-final constituent, in this case the syllable, can be made invisible to the MSR by making it extrametrical (Hayes 1982). Extrametricality can either be imposed by rule, or be marked in the lexical representation of a word. For words ending in -VC we impose extrametricality by rule:

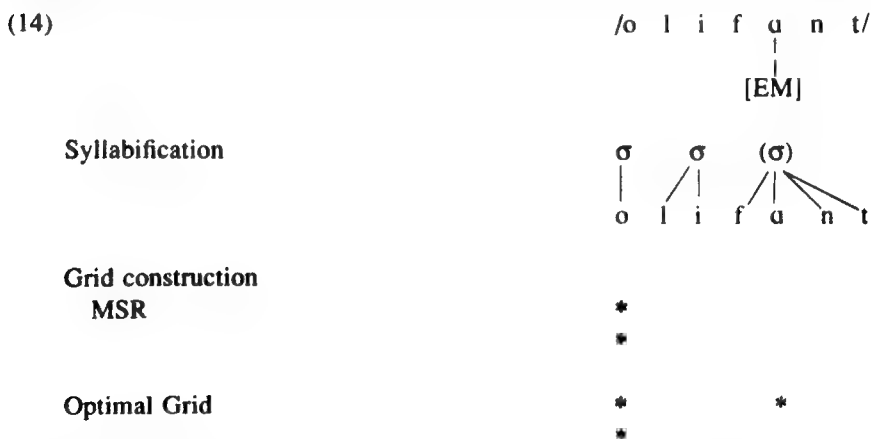
(13) Extrametricality Rule

Make word-final syllables with a VC-rhyme extrametrical

This rule applies to words like *bivak* /bivak/ 'bivouac' and *Michael* /mixael/ 'id.'. So we create a monosyllabic foot on the first syllable of *bivak*, ignoring the second syllable, and a binary foot on the part (mixa) of *Michael*. Of course, words in -VC that have final stress, must be marked as exceptions to this rule of extrametricality. Rule (13) expresses that a majority of words in -VC do not have final stress, but there is a substantial number of words ending in -VC with final stress, for example, *kartón* 'cardboard' and *kanón* 'gun'.

Extrametricality may also have to be marked on specific lexical items. At the underlying level, we do not have syllables, so we cannot mark syllables as extrametrical in underlying representations. Instead, we mark the relevant vowel, the head of the syllable, as extrametrical, and this property can then be percolated from the head to the syllable node, once the syllable nodes have been introduced by the syllabification algorithm.

In a word like *olifant* /olifant/ 'elephant', the /a/ will be marked as EM (extrametrical). Consequently, foot construction will apply to the part /oli/, and thus locate stress on the first syllable. Subsequently, a second stress will be introduced by the general rule that creates rhythmic alternations of stressed and unstressed syllables, and thus creates optimal grids, the Optimal Grid Rule.



Note that the extrametricality feature is only relevant for the location of main stress, since the last syllable of, for example, *olifant* does get secondary stress.

Certain regularities as to extrametricality can be found. For instance, words ending in VCs, such as *climax* /klimaks/ 'id.' and *larynx* /larɪŋks/ 'id.' usually have prefinal stress, and thus their final syllables may be made extrametrical by rule.

How do we account for cases of antepenultimate stress like *calcium* 'id.' and *ária* 'id.'? In these words, the last syllable should also be marked as extrametrical. There are certain generalizations involved here that have to do with the prefinal and final syllables since specific combinations lead to final extrametricality, in particular with penultimate syllables containing /i/. The historical background is that these are words from Latin or formed after a Latin model, and the corresponding /i/ in Latin was short, thus giving rise to light syllables, to be skipped in stress assignment. In addition, we find Germanic geographical names with initial stress and specific endings such as *-uwe*:

- (15) *-ium* /iym/:           gymnásium 'id.', geránium 'id.', critérium 'criterion'  
*-i(C)o* /iCo/:           rátio 'id.', légio 'many', Pinócchio 'id.', líbido 'id.',  
                                   rísico 'risk'  
*-ina* /ina/:           página 'page', vágina 'id.'  
*-ika* /ika/:           Amérika 'America', Áfrika 'Africa', lógika 'logic'  
*-ier* /iær/:           agráriier 'farmer', Austrálie 'Australia', proletáriier  
                                   'proletarian'  
*-icus* /ikys/:           médicus 'doctor', lógicus 'logician', chémicus  
                                   'chemist'  
*-ia* /ia/:           pária 'pariah', ária 'id.', malária 'id.'  
*-uwe* /yʊə/:           Bétuwe 'id.' (geographical name), Véluwe 'id.'  
                                   (geographical name)<sup>9</sup>

Such generalizations concerning certain /i/-combinations (but not all, compare *sulfide* /sʏlfidə/ 'sulphide' and *marine* /marinə/ 'navy') and *-uwe* can be expressed by rules that predict the feature [extrametrical].

Words ending in *-or* are special in that the final syllable does not receive main stress, but the penultimate, which can be an open syllable:

- (16) mótór 'engine'  
       condensátor 'id.'  
       alligátor 'id.'

So here, the 'light' penultimate syllable is not skipped. The correct stress pattern can be derived by making the final /r/ in word-final *-or* extrametrical by rule. This more specific rule will take precedence over the general rule that makes final VC-syllables extrametrical. The MSR will then assign main stress to the penultimate syllable.

A second type of lexical exception mechanism is to be introduced for words

<sup>9</sup> These words are exceptions to the generalization in Kager and Zonneveld (1986) that it is the syllable before the schwa that always receives main stress, i.e. pre-schwa syllables cannot be skipped in main stress assignment.

ending in vowels that have final stress, words like *melodie* and *trofee*. These words will have to be marked with an exception feature [+F] (for [+French]), and we will have to add to the MSR that a trough cannot dominate the feature [+F]. Thus, a monosyllabic foot will be created at the end of such words.

Finally, there remain a number of words, in particular, geographical names, that have initial stress, which cannot be assigned by making use of extrametricality of the last syllable because they consist of four syllables, or three syllables of which the second is heavy. The only way to derive the correct stress pattern is to assume a minor stress rule for words marked as [+G] (for [+Germanic]) that assigns stress to the first stressable syllable. Examples are geographical names like:

- (17) Wágeningen /vayəŋɪŋən/, Éverdingen /evərɪŋən/, Ámerongen /amərɔŋən/, Léeuwarden /levurdən/ 'id.'

Note that in *Leeuwarden* the penultimate syllable is closed, and hence it cannot be skipped by the MSR. Again, we might invoke redundancy rules to predict [+G], for instance on the basis of the property 'geographical name'. The minor stress rule that is triggered by [+G] takes precedence over the Main Stress Rule, as predicted by the Elsewhere Principle.

The [+G] rule also has to apply to a few quadrisyllabic words of Latin origin with initial stress such as *ínfinitief* 'infinitive' and *áccusatief* 'accusative' which emphasizes that features such as [+G] have no diachronic status.<sup>10</sup>

The way in which the MSR is formulated predicts how words that are incorrectly stressed behave. For instance, words like *nótulen* /notylən/ 'minutes', *eméritus* /emeritys/ 'id.', and *normáliter* /nɔrmalɪtɛr/ 'normally' require extrametricality to get the correct antepenultimate stress, and people indeed tend to give these words penultimate stress, as would be the case if there were no extrametricality (in that case the last vowel of *normaliter* is pronounced as schwa). Similarly, the word *hysteríe* /histeri/ 'hysteria' which is marked as [+F], is often pronounced with prefinal stress. Also, many speakers of Dutch pronounce *Leeuwarden* with prefinal instead of initial stress.<sup>11</sup>

The distinction between native and non-native words is not always easy to make. As long as a word does not form input for non-native word formation, we have no evidence. Non-native suffixes, on the other hand, form a clearly distinguishable class on the basis of morphology, and this correlates with their phonological behaviour. When they end in VVC or VCC, they always bear main stress, whereas non-native lexical morphemes ending in VVC or VCC can be extrametrical, as illustrated by *índex* and *lárynx*.<sup>12</sup> The suffixes *-ica* and *-ikus* (as in *elektron-ika* 'electronics', *elektron-ikus* 'electric engineer') have

<sup>10</sup> However, some speakers of Dutch pronounce these words with final stress.

<sup>11</sup> Cf. Neijt and Van Heuven (1992) for a discussion of the types of exceptional word stress in Dutch, and the available exception mechanisms.

<sup>12</sup> Compare *indic+eer* and *larynx+aal* which prove the non-native nature of their base words, because *-eer* and *-aal* are [-native].

an extrametrical final syllable, and thus get main stress on the presuffixal syllable.<sup>13</sup>

### 5.2.1. Secondary stress

As pointed out above, words may also have secondary stresses, in conformity with principle (5), as illustrated below:<sup>14</sup>

- (18) au to maat                      do mi nee  
       \*                \*                      \*                \*  
                       \*                      \*  
  
 fo no lo gie                      in fi ni tief                      ka ta lo gus  
       \*                \*                      \*                \*                      \*                \*  
                       \*                      \*                                      \*  
  
 ste ro i de                      Wa gə nin gən  
       \*                \*                      \*                \*  
                       \*                      \*  
  
 en cy clo pe die                      en cy clo pe disch  
       \*                \*                \*                      \*                      \*  
   \*                                      \*  
  
 en cy clo pe do loog                      en do cri no lo gie  
       \*                        \*                \*                      \*                \*                \*  
   \*    \*

I assume that the relevant rule, the Optimal Grid Rule, applies after the main stress of a word has been determined. The Optimal Grid Rule adds asterisks on line 1. Subsequently, binary, left-dominant feet are created when possible. In some of these examples, it is impossible to create a really perfect grid of rhythmically alternating syllables, for instance in *fònologie*. In this word, the third syllable cannot receive secondary stress because it would clash with the next main stress. The crucial observation is that it is the first rather than the second syllable that receives secondary stress. In other words, Dutch prefers stresses at (prosodic) word boundaries. This principle, described in Booij (1981a: 166–9), is sometimes referred to as the Hammock Principle (Van Zonneveld 1985). The mirror image case is *infinítief* with secondary stress on the final rather than the prefinal syllable. Note also that in words

<sup>13</sup> In female names such as *Jantina* and *Henderika* main stress is on the penultimate syllable. Such names can be analysed as suffixed with the feminine suffix *-a*, attached to the stems of Latinized forms of masculine names such as *Jantin-us* and *Henderik-us*. So they have the normal stress pattern of suffixed non-native words, and this explains the difference in stress with words like *elektrón-ika* and *elektrón-icus*, where different suffixes are involved.

<sup>14</sup> The respective meanings of these words are 'automaton', 'parson', 'phonology', 'infinitive', 'catalogue', 'steroid', 'Wageningen', 'encyclopaedia', 'encyclopaedic', 'encyclopaedist', 'endocrinology'.



with initial stress like *Wágeningen*, a secondary stress appears on the third syllable. When two secondary stresses are assigned there may be some variation as to the location of the word-internal secondary stress: in *èncyclopèdo-lóog* it is on the fourth syllable, in *èndocrinológíe* on the third (Hoeksema and Van Zonneveld 1984). The difference may have to do with the interpretation of *endo-* as a non-native prefix.

These observations lead to the conclusion that we should not derive secondary stresses by iterative application of the Main Stress Rule, which creates sequences of feet, and thus an alternating pattern, because the Main Stress Rule would derive secondary stress on the second syllable, instead of on the first syllable of *fonológíe*. Secondly, whereas the MSR is a directional rule, applying from right to left, the rule for secondary stresses must be able to apply from both sides of the word, depending on the location of the main stress, as shown by the pair *ínfínítíef-fónológíe*, and the pair *hórízòn 'id.'-klàrínét 'clarinet'*.

An additional but logically independent issue is whether the assignment of secondary stresses in Dutch is sensitive to the segmental composition of the syllable ('syllable weight'). The analysis given here assumes that this is not the case for Dutch. The opposite position is taken by Kager (1989) who argues that there is certain evidence that closed syllables and syllables with a diphthong have inherent stress. The evidence concerns certain stress patterns, vowel-reduction possibilities (to be discussed in detail in Section 6.4), and Trochaic Reversal.

Kager (1989: 290) observed that it is possible to have secondary stress on the second syllables of the words *melancholíef* 'melancholic' and *gerontológíe* 'gerontology', alongside the possibility of initial secondary stress. This would follow from stress being assigned by weight. However, in many words we get word-initial secondary stress even when the second syllable is closed, as in *ídentitéít* 'identity', *túberculóse* 'tuberculosis' and *cònservatíef* 'conservative'. So it seems that non-initial secondary stress is not a systematic phenomenon. Note, moreover, that non-initial secondary stress also occurs in some words although the second syllable is light, as in *piràteríj* 'pirate actions' and *grammàtikáál* 'grammatical'.

Vowels in open syllables indeed reduce easier than vowels in closed syllables, and diphthongs never reduce to schwa. Nevertheless, vowels in closed, that is, 'heavy' syllables can reduce. For instance, in *ànekdoté* /anɛkdotə/ 'anecdote' the second syllable is closed. Yet, reduction of the vowel is possible, which forces Kager to add a rule that reduces the stress of closed syllables in certain configurations. In the approach taken here, the second syllable does not take stress, and hence the vowel can reduce. The fact that diphthongs do not reduce may be related to a more general tendency, namely that diphthongs do not undergo rules which apply to stable long vowels. For instance, they also do not undergo the rule of word-initial vowel shortening (Section 6.5) that applies in stressed syllables.

Trochaic Reversal is the phenomenon discussed above in (3) with respect to the stress pattern of *dorpsdominee*. It seems that this kind of reversal sometimes leads to a shift of stress to the final syllable of a bisyllabic word forming the right constituent of compounds, as in *Bosatlas* 'id.' (Bos is the author of this atlas), *jeugdherberg* 'youth hostel', and *bloedlichaam* 'blood corpuscle'. The rhythmic reversal is illustrated for *Bosatlas*, for analyses with and without inherent weight:

(19) <i>With inherent weight</i>			<i>Without inherent weight</i>		
bos	at	las	bos	at	las
*	*	*	*	*	
*	⊗	→	*	⊗	→
*			*		

Kager's argument in favour of the weight analysis is that stress shift does not occur on words ending in a vowel. For instance, in *postgiro* 'giro', stress cannot be shifted to the last syllable. Gussenhoven (1984: 305), however, provides the example *tandpasta* 'toothpaste' where Trochaic Reversal does occur, and hence the second vowel can reduce: [tampəsta]. Also, Visch (1989: 129) gives a number of examples in which the secondary stress cannot shift although the relevant syllable to which the stress would move, is heavy: *áartsvijand* 'arch-enemy', *húlpròbot* '(lit.) help robot', and *bórstsierraad* 'breast ornament'. In short, Trochaic Reversal phenomena do not lead to clear conclusions. We should also keep in mind that in words such as *dominee* 'parson', the last, open syllable gets secondary stress anyway, also in Kager's analysis,<sup>15</sup> although it is a 'light' syllable.

Moreover, it appears that the inverse of Trochaic Reversal, Iambic Reversal, which takes place in phrases, is sometimes possible with stress shift to open syllables, as the following examples (from Kager 1989: 279) illustrate:<sup>16</sup>

(20) vocáal 'vocal'	vòcale stéun 'vocal support'
neutráal 'neutral'	nèutrale ópstelling 'neutral position'
primáir 'primary'	primaire kénmerken 'primary features'

An argument in favour of the analysis presented here is that the rule for assignment of secondary stress applies throughout the lexicon, i.e., also to complex words with native, stress-neutral suffixes, that do not trigger application of the MSR. For instance, the word *wandeling* /wándəlɪŋ/ 'walk', with the stress-neutral suffix *-ing* /ɪŋ/ bears secondary stress on the final syllable, which is confirmed by the fact that it selects the diminutive allomorph *-etje* that only occurs after stressed syllables. On the other hand, bisyllabic words ending in *-ing* like *paling* 'eel' get the allomorph *-kje*. Note that this also speaks against assigning inherent stress to closed syllables, since then the final syllable of

<sup>15</sup> Kager derives this secondary stress by assigning lexical stress to the vowel of the last syllable of *dominee*, thus allowing lexical stress assignment to violate the weight condition.

<sup>16</sup> As we will see in Section 7.4 these patterns are still acceptable.

*paling* would bear stress, and we can no longer predict the choice of the correct diminutive allomorph.

Another relevant native suffix is *-nis*: in *vuilnis* 'garbage', the second syllable is stressless, and the underlying /i/ can reduce to schwa. In *droefenis* 'sadness', on the other hand, the last syllable receives rhythmical stress, and thus it is correctly predicted that here the /i/ does not reduce. Again, this shows that the Optimal Grid Rule applies to the native complex words as well.

In sum, there are two choices to be made for each language with respect to secondary stress:

- (a) is it weight-sensitive or only determined by rhythmic alternation?
- (b) does it apply in the same direction as the MSR or from the other direction?

These choices appear to be independent. According to Halle and Kenstowicz (1991), English is weight-sensitive, but secondary stress does not apply in the same direction as the MSR, and Spanish is just the other way round: secondary stress is not weight-sensitive, but applies in the same direction as the MSR, i.e., from right to left. According to Kager (1989) Dutch secondary stress is weight-sensitive, and is assigned in the same direction as the MSR, whereas here, the opposite choice is made for both parameters, which makes Dutch in this respect equal to, for instance, Polish (cf. Rubach and Booij 1985).

In conclusion, the following phonological rule of Dutch accounts for secondary stress:<sup>17</sup>

#### (21) Optimal Grid Rule

Assign line-1 \*s to syllables within a prosodic word under the following conditions:

- (a) no adjacent \*s;
- (b) if possible, insert \* on syllables at word edges (the Hammock Principle).

In the initially stressed *Wágeningen* a secondary stress on the final syllable is

<sup>17</sup> The analysis in which main stress is assigned first, and then secondary stress by a separate rule, was proposed in Booij (1981a: ch. 9), and is also defended in Van Zonneveld (1985) and Van der Hulst (1984). As argued in Rubach and Booij (1985), secondary stress in Polish is assigned according to the same principles of 'main stress first' (in the penultimate), and then secondary-stress assignment from both word edges. Vogel and Scalise (1982) defend this approach for Italian, and Halle and Kenstowicz (1991) argue in favour of such a rule of secondary-stress assignment for English, in the case of English only from the left edge of the word, i.e. on the part of the word before the main stress. In their opinion the fact that the secondary-stress rule starts from the word edge follows from the 'cross-over constraint' that says that 'metrification' (the construction of metrical feet) can only affect elements that have not yet been parsed. Roca (1986, forthcoming) also argues that secondary stress in Spanish is determined by rhythmic principles rather than by an iterative Main Stress Rule. Other evidence is summarized in Van de Vijver (1993).

Strictly speaking, secondary-stress assignment is not one rule in the case of Dutch because it applies from both word edges. One may conceive of it as imposing a certain template on line 1 of the metrical grids of words.

impossible because it contains a schwa. Hence, the secondary stress is located in the prefinal syllable.

The principle that adjacent stresses are forbidden only holds within prosodic words. For instance, as shown above, the compound *dorpsdominee* does allow for adjacent stresses, even after the stress clash has been removed.

### 5.2.2. Cyclicity of stress assignment

If the MSR applies when possible, the rule will apply cyclically without any further stipulation, given the organization of the grammar as outlined in Section 4.1. The question is whether this is a desirable result. In Chomsky and Halle (1968), the rule for English word stress is assigned cyclically. On each subsequent cycle, main stress is reassigned, and the primary stress of the previous cycle is lowered by one degree by convention. If we applied this theory to Dutch, the following stress patterns for words such as *profeteer* 'to prophesize' and *kanaliseer* 'to canalize' would result:

(22) 1st cycle:	profet	kanaal
MSR	1	1
2nd cycle:	+eer	+iseer
MSR	1	1
Stress Lowering	2	2

So, we derive the wrong stress patterns *profètээр* and *kanàlisээр* instead of the correct patterns with secondary stress on the word-initial syllables. The correctness of the given patterns can be deduced from the vowel-reduction possibilities: in both words, the vowel of the second syllable can reduce: [profète:r], [kanalize:r]. In the case of *profeteer* we might explain this by a rule of stress shift that shifts the secondary stress from its prestress position, in order to get a more optimal rhythmic pattern. In the case of *kanaliseer*, this explanation does not go through since the cyclic derivation does derive an alternating pattern, as shown above.<sup>18</sup> In other words, derived words, at least those derived by means of non-native suffixes, behave as underived words with respect to stress. Two different conclusions may be drawn from this observation: either main stress is assigned cyclically, but a Stress Erasure Convention erases it when a new cycle is created through the addition of an affix, or the MSR is a rule that applies after the non-native morphology. The first proposal, cyclic assignment plus a Stress Erasure Convention, is that of Halle and Vergnaud (1987: 83). This convention states that existing stresses within the

<sup>18</sup> There are a few words, though, with non-initial stress that correlates with the position of the main stress in the base word: *piraat*—*piraterij*, *grammatika*—*grammatikaal*. In *grammatikaal* it is the vowel of the first rather than that of the second syllable that can be reduced to schwa. They might be seen as lexically governed exceptions to the Stress Erasure Convention. Comparable lexical exceptions appear to exist for English. For instance, in *originality* the second syllable bears stress, instead of the first one, a reflection of the main stress on the second syllable of its base word *original* (Halle and Kenstowicz 1991: 491).

domain of the prosodic word to which the MSR reapplies are erased. I will assume it as well, since there is another argument for cyclicity of stress assignment: morphological and phonological rules may require information about the stress pattern of a word. For instance, the adjectival suffix *-ief* only attaches to nouns ending in unstressed *-ie* (in other cases the suffix *-isch* is used, cf. Booij and Rubach (1987)):

- |         |                                 |                                  |
|---------|---------------------------------|----------------------------------|
| (23) a. | <i>agressie</i> 'aggression'    | <i>agressief</i> 'aggressive'    |
|         | <i>indicatie</i> 'indication'   | <i>indicatief</i> 'indicative'   |
|         | <i>restrictie</i> 'restriction' | <i>restrictief</i> 'restrictive' |
| b.      | <i>hysterie</i> 'hysteria'      | <i>hysterisch</i> 'hysterical'   |
|         | <i>democratie</i> 'democracy'   | <i>demokratisch</i> 'democratic' |
|         | <i>algebra</i> 'id.'            | <i>algebraisch</i> 'algebraic'   |

Note that the words in unstressed *-ie* are the ones with the regular stress pattern, so we cannot refer to some diacritic feature of words like *agressie*.<sup>19</sup>

In Chapter 4 we also encountered a case where the correct application of a rule of vowel lengthening is dependent on information about the stress pattern on the previous cycle: the rule of Vowel Lengthening in the non-native lexicon (Section 4.4.4).<sup>20</sup>

In sum, like English (Halle and Vergnaud 1987: 83), Dutch has a class of cyclic suffixes that do not themselves form domains of stress assignment; they therefore trigger reapplication of the MSR and erase the existing stress pattern of the base. Below, we will see that the class of cyclic suffixes is somewhat larger than the class of non-native suffixes.

### 5.3. WORD STRESS AND NATIVE SUFFIXATION

Above we saw that the MSR holds for (native and non-native) underived words, and for non-native complex words. This layer of the lexicon is often referred to as 'stratum 1' or 'level 1'. The only clear level-1 rule that we have encountered so far is the MSR. The rules discussed in Chapter 4 were either

<sup>19</sup> An alternative analysis is proposed in Odden (1990). Odden assumes that in words like *psychologie* with irregular word-final stress, this stress is already present in the underlying representation. Since *-ief* only attaches to words without stress, it cannot attach to *psychologie*. Thus, in Odden's analysis morphology precedes phonology, whereas in Lexical Phonology, the model that Odden criticizes, morphology and phonology are interspersed.

Apart from the problem whether it is a good idea to encode main stress in lexical representations, there are many more cases in the literature where stress appears to condition morphology. A survey of these facts is given in Booij (1988b, 1992c). For instance, in Dutch the choice of the correct plural suffix partially depends on the stress pattern of the base word.

<sup>20</sup> As pointed out in Section 4.4.4, in the case of vowel lengthening the assignment of a lexical marker for stress to which a rule could refer is not sufficient to get the right results, and phenomena analysed there form a strong argument for cyclic stress assignment.

P-rules, not restricted to a particular layer of the lexicon, or MP-rules, which were either characteristic for non-native or for native words.

The native suffixes of Dutch can be divided into three classes:

- (a) stress-neutral suffixes
- (b) stress-bearing suffixes
- (c) stress-shifting suffixes.

They will be discussed in the next subsections.

### 5.3.1. *Stress-neutral suffixes*

Most native suffixes of Dutch are stress-neutral, that is, they do not influence the position of the main stress of their base word. There are two categories of stress-neutral suffixes to be distinguished since some of them form prosodic words of their own, the so-called non-cohering suffixes:

#### (24) a. *Cohering suffixes*

- e /ə/ (several functions)
- el /əl/ (denominal verbalizing suff.)
- en /ən/ (pl. suff.)
- er /ər/ (several functions, plus allomorph /ar/)
- erd /ərd/ (creates de-adjectival pej. names)
- erig /ərɪŋ/ '-ish'
- ing /ɪŋ/ '-ing'
- nis /nɪs/ '-ness'
- s /s/ (substantivizing suff., pl. suff., gen. suff.)
- sel /səl/ (creates de-verbal obj. names)
- st /st/ (super., de-verbal nominalizing suff.)
- ster /stər/ (feminizing suff.)
- t /t/ (de-verbal nominalizing suff.)
- te /tə/ '-ness' (past tense)
- tje /tjə/ (dimin., + 4 allomorphs)

#### b. *Non-cohering suffixes*<sup>21</sup>

- achtig /ɑxtəŋ/ '-like'
- baar /bat/ '-able'
- dom /dɔm/ '-dom'
- heid /heid/ '-ness'
- ling /lɪŋ/ '-ling'
- loos /los/ '-less'
- schap /sxɑp/ '-ship'

It is almost completely predictable whether a native suffix will be non-cohering or not. The rule is: a native suffix that could form a prosodic word of its own,

<sup>21</sup> The non-cohering suffix *-zaam* is dealt with in Section 5.3.3, where *-baar* also recurs.

does it, except for *-ing* and *-nis*.<sup>22</sup> By definition, non-cohering suffixes are not cyclic suffixes, and hence they do not affect the main stress of their input words. In order to account for the stress-neutrality of the stress-neutral cohering suffixes, we have to mark them as non-cyclic suffixes. In most cases, this marking can be predicted from the fact that these suffixes are either nominalizing or inflectional [+native] suffixes.

On the other hand, the Optimal Grid Rule is a purely phonological rule, and applies if possible. Thus, in *wandeling* /wándəlɪŋ/ 'walk' derived from the verb *wandel* 'to walk', the MSR assigns main stress to the initial syllable. After the affixation of *-ing*, a non-cyclic suffix, the MSR does not reapply, but the Optimal Grid Rule is applicable since there is now a syllable with a full vowel, introduced by the suffix *-ing*, and it will assign secondary stress to the last syllable.

The Optimal Grid Rule is, when nothing is said, a cyclic rule (although its effects will be erased by the Stress Erasure Convention). This is in harmony with the fact that in the allomorphy of the diminutive suffix the location of secondary stress may play a role, as is the case for *wándeling* 'walk' with the diminutive *wandelingetje*. If the Optimal Grid Rule were a word-level rule, and thus applied after the MP-rules triggered by the native morphology, the relevant information that the last syllable of *wandeling* has secondary stress, would not be available.

The effect of adding stress-neutral suffixes with only schwas is that we may get complex words with a sequence of unstressed syllables, as illustrated by *gemakkelijk*, the comparative form of *gemakkelijk* 'easy', itself derived from *gemak* /ɣəmək/ 'easiness' by means of the suffix *-elijk* /ələk/:

(25) ɣə mə kə lə kər

\*

line 1

\*

line 2

It should also be noted that the stress-neutrality of these suffixes does not follow from their containing schwas. For instance, in the adjective *júdasseriġ* [jɥdəsərəx] 'Judas-like', the stress is not on the last full vowel, as would be expected if we determined the stress pattern anew, but on the first one, corresponding with the main stress on the first syllable of *Júdas* 'id.'.

The non-cohering native suffixes have an internal stress pattern. For instance, in *-achtig* the first syllable bears stress. The other non-cohering suffixes are monosyllabic. Like monosyllabic words of lexical categories, they will automatically receive main stress, i.e., \*s at level 1 and level 2. Of course, the fact that monosyllabic prosodic words have main stress is not specific for level 1, but is valid across the lexicon. Similarly, since across the lexicon a schwa cannot receive stress, the initial stress of *-achtig* /axtəɣ/ is predictable. Words like *rood-achtig* 'reddish' and *eet-baar* 'edible' are compounds of two

<sup>22</sup> Some speakers always realize *-nis* as [nəs]. Thus, for these speakers, *-nis* is no exception, but is predictably a cohering suffix.

prosodic words, and thus they will be subject to the stress rule for compounds to be discussed in Section 5.4 which states that the first prosodic word gets an asterisk on line 3:

(26)	(rood) <sub>ω</sub>	(ach tig) <sub>ω</sub>	(eet) <sub>ω</sub>	(baar) <sub>ω</sub>	
	*	*	*	*	line 1
	*	*	*	*	line 2
	*		*		line 3

### 5.3.2. Stress-bearing suffixes

There are four native suffixes that bear the main stress of the words that they form:

(27)	-erij /əɾɛi/	schiet-erij 'shooting', et-erij 'eating'
	-es /ɛs/	voogd-es 'fem. guardian' (fem.)
	-in /ɪn/	hel-din 'heroine', leeuw-in 'lioness'
	-ij /ɛi/	voogd-ij 'guardianship, abd-ij 'abbey'

These words are native suffixes as proven by the fact that they attach typically to native base words. Therefore, these native suffixes have to be marked as cyclic suffixes. Moreover, the final consonants of the suffixes *-es* and *-in* have to be marked as exceptions to the rule of final VC-extrametricity discussed above, because they bear the main stress of the word, or they are to be marked as [+F].

It is worth discussing how the grammar developed here will derive the stress pattern of *maatschappij* 'society' which is derived by suffixation of *-ij* to the base word *maatschap* '(lit) mateship' that in its turn contains the non-cohering suffix *-schap*. In *maatschap* the first syllable bears main stress, and the second syllable bears secondary stress because it is a prosodic word in its own right. In other words, stress is as predicted by the Compound Stress Rule to be discussed below. In *maatschappij* the cohering suffix *-ij* is added to the prosodic word *-schap*. The cohering nature of this suffix is also clear from its resyllabification effect: the final /p/ of *-schap* forms a syllable with *-ij*. So we get the following stress patterns:

(28)	(maat) <sub>ω</sub>	(schap) <sub>ω</sub>	(maat) <sub>ω</sub>	(schap pij) <sub>ω</sub>	
	*	*	*	*	line 1
	*	*		*	line 2
	*				line 3

Since *-ij* is a cyclic suffix, it will delete previously assigned stresses. The second syllable of *maatschappij* is indeed stressless and the vowel can be reduced to schwa: [matʰsxəpɛi]. The removal of the original stress pattern of *maatschap* follows from the Stress Erasure Convention. Finally, note that the original prosodic structure does not seem to play a role in the determination of the main stress. That is, we have to assume that after stress erasure, the MSR



which normally applies in the domain of the prosodic word, can extend its domain, and also apply across a prosodic word boundary.

### 5.3.3. Stress-shifting suffixes

A third category of native suffixes requires the main stress of the word to be located on the last stressable syllable before the suffix. They are all adjectival suffixes (cf. Schultink 1980):

- |      |                 |   |
|------|-----------------|---|
| (29) | -baar /bar/     | overdraagbaar 'transferable'                            |
|      | -end /ənd/      | omármend 'embracing'                                    |
|      | -ig /əɣ/        | driehóekig 'triangular'                                 |
|      | -isch /is/      | afgódisch 'idolatric'                                   |
|      | -(e)lijk /ələk/ | hartstóchtelijk 'passionate', aanzénlijk 'considerable' |
|      | -s /s/          | goedláchs 'merry'                                       |
|      | -zaam /zam/     | mededéelzaam 'communicative'                            |

A remarkable detail is that the suffix *-baar* only attracts main stress if the base word is a so-called separable complex verb.<sup>23</sup> For instance, *overdraagbaar* is derived from the separable complex verb *overdragen* 'to transfer'. On the other hand, when we add *-baar* to the complex verb *beïnvloeden* 'to influence' which is not a separable complex verb, the main stress remains where it was, on the syllable *in*. Furthermore, if *-loos* is preceded by a schwa, it may also attract stress, as in *hartstóchteloos* 'passionless'. Finally, stress shift is also observed for the sequence of suffixes *-loosheid*, where main stress is located on *-loos*, as in *werkelóosheid* 'joblessness'.<sup>24</sup> The relevant generalization is:

- (30) Assign main stress to the last stressable syllable before the suffix in adjectives ending in *-baar*, *-end*, *-ig*, *-isch*, *-(e)lijk*, *-s*, and *-zaam*.

Clearly, these suffixes also have to be qualified as cyclic suffixes, in that they erase the existing stress pattern, and trigger reassignment of Main Stress. The suffixes *-end*, *-ig*, and *-(e)lijk* are then completely regular: they cannot bear main stress themselves since they do not contain full vowels. The other three suffixes are irregular in that they require main stress on the syllable before the suffix.

Just as in the case of *maatschappij*, the effect of this special rule is that the second prosodic word of the adjective bears main stress:

- |      |                         |  |                      |
|------|-------------------------|--|----------------------|
| (31) | Morphological structure | [[[mat] <sub>N</sub> sxʊp] <sub>N</sub> ələk] <sub>A</sub> |                      |
|      | Prosodic structure      | (mat) <sub>ω</sub> (sxʊpələk) <sub>ω</sub>                 |                      |
|      | Stress grid             | line 1   | *                  * |
|      |                         | line 2   | *                    |

<sup>23</sup> In main clauses the verbal part of separable complex verbs stands in second position, whereas the particle is clause-final; cf. Booij (1990a) for a morphological analysis of these verbs.

<sup>24</sup> The proper analysis of these complicated facts is discussed in Neijt and Zonneveld (1981), Kooij and Van der Niet (1985), and De Haas (1985, 1991).

To summarize, there is a number of adjectival native suffixes that have to be qualified as cyclic suffixes.

#### 5.4. COMPOUND STRESS

The basic stress pattern for compounds is that the first of the two constituents is the most prominent one (the strong-weak pattern). The most productive category of compounds is that of nominal compounds. Verbal compounds are rare (but do exist), and adjectival compounds also form a productive category, but their constituents are usually non-compounds (i.e. adjectival compounding does not allow for recursivity).<sup>25</sup> The following rule accounts for compound stress:

##### (32) Compound Stress Rule (CSR)

Add an \* to the leftmost prosodic word on the next line.

The following derivations illustrate the (cyclic) application of this rule to the compound *onderzoekfonds* 'research fund':

(33)	[[[onder]	[zoek]]	[fonds]]	
1st cycle: MSR	*	*	*	line 1
	*	*	*	line 2
2nd cycle: CSR	_____			line 3
3rd cycle: CSR	*		*	line 3
	*			line 4

By convention, the application of the CSR at line 4 also introduces an \* for *fonds* at line 3 because before each application of the CSR the two constituents involved must be represented at the same number of lines. This correctly expresses that in the word under discussion the constituent *fonds* is more prominent than the constituent *zoek*. Recall that the stress grids are assigned to prosodic constituents. Therefore, the CSR also applies to complex words that are not compounds from the morphological point of view, but nevertheless consist of two prosodic words, for instance the complex adjectives *kléurlòos* 'colourless' and *dráagbàar* 'portable', and the complex nouns *schóonhèid* 'beauty' and *léerling* 'pupil'.

Let us now look at the derivation of the stress grid of *kankeronderzoek* 'cancer research' as given in (34).

The then-resulting grid may seem to exhibit a configuration of stress clash. Stress clash is defined as the configuration in which two \*s are adjacent at line

<sup>25</sup> Cf. Langeweg (1988), Visch (1989), and Booij (1992b) for a survey of Dutch compounding, and the different stress patterns.

(34)	[[kanker]	[[onder]	[zoek]]]	
1st cycle: MSR	*	*	*	line 1
	*	*	*	line 2
	<hr/>	<hr/>	<hr/>	
2nd cycle: CSR		*		line 3
		<hr/>		
3rd cycle: CSR	*			line 3
	*			line 4

$n$  and line  $n - 1$  (Lieberman and Prince 1977, Prince 1983). The clash will be resolved by Trochaic Reversal, that is, movement of the line-3 \* of the syllable *on* to the syllable *zoek*. In other words, the pattern 1–2–3 is changed into 1–3–2. Similar examples are *táalwetenschàp* '(lit.) language science', *stáatseigen-dòm* 'state property', and *hóofdschakelàur* 'main switch' (Visch 1989: 131).

The interpretation of stress shift as 'Move \*' correctly predicts that if the second constituent of a compound is bisyllabic, and thus forms one bisyllabic foot, the stress shift is impossible, because it would result in an ill-formed grid, with no grid entry for the final syllable at line 1:<sup>26</sup>

(35)	post	gi	ro	
	*	*		line 1
	*	(*)	→	line 2
	*			line 3

Therefore, stress shift is impossible in the following cases (data partially from Visch 1989: 128):

(36)	póstgìro	*póstgìrò	'giro'
	blóedplàsma	*blóedplasmà	'blood plasma'
	gráansilò	*gráansilò	'grain elevator'
	jáarprèmie	*jáarpremie	'annual premium'
	kóorkànon	*kóorkanòn	'choir canon'
	rídderhàrnas	*rídderharnàs	'knight's cuirass'

Exceptions to this restriction are words like *Bosatlas* and *tandpasta* mentioned above, and a few compounds (Visch 1989: 128) such as *bloedlichaam* 'blood cell' and *booreiland* 'oil rig': they allow for Trochaic Reversal to apply. *Bosatlas* and *tandpasta* may be seen as lexicalizations that form only one prosodic word (the Optimal Grid Principle will then assign secondary stress to the last syllable), whereas words like *lichaam* 'body' and *eiland* 'island' can be interpreted as formal compounds, thus allowing for stress shift:

<sup>26</sup> In Visch (1989: 126) Trochaic Reversal is analysed in the tree-cum-grid framework of Hayes (1984). This means that the grid functions primarily as an interpretational device. When a stress clash arises, restructuring and relabelling of the metrical tree takes place. Trochaic Reversal is formalized as the adjunction of a constituent that does not contain the Designated Terminal Element of the constituent in which the stress clash takes place to the preceding constituent, which becomes strong, since an adjoined constituent is always weak.

- (37) boor    ei    land
- |   |       |   |        |
|---|-------|---|--------|
| * | *     | * | line 1 |
| * | *     | * | line 2 |
| * | ⊗ → - |   | line 3 |
| * |       |   | line 4 |

The analysis given here also correctly predicts that Trochaic Reversal does not always apply to compounds with a second constituent ending in the suffix *-ing*:

- (38) prjfsstijging → \*prjfsstijgèng 'price increase'  
wéersverwàchting → \*wéersverwàchtèng 'weather forecast'  
bós-wàndeling → bós-wàndelèng 'forest walk'  
wéersveràndering → wéersverànderèng 'weather change'

In the last two examples, the final syllable of the second constituent receives stress from the Optimal Grid Rule, and hence it is a proper location for 'Move \*' to move an asterisk to:

- (39) prijs stij ging versus bos wan de ling  
 \* \* \*  
 \* \* \*  
 \* \* \*

There are certain exceptions to the CSR, established compounds with main stress on the second constituent instead of on the first:

- (40) [staats][bósbeheer] 'forestry commission'  
[kinder][bíjslag]<sup>27</sup> 'child allowance'  
[stad][húis] 'town hall'  
[boeren][zóon] 'farmer's son'

An even more exceptional stress pattern that is sometimes heard is *arbeidsvoorwaardenbelèid* 'terms of employment policy' with main stress on *voor*, the morphologically most deeply embedded constituent. This type of stress pattern is the regular one for cases where a phrase functions as the first part of a compound. I will assume that within the phrase, stress is assigned by a noun phrase stress rule (NSR) which assigns stress to the head of a nominal phrase within compounds, as illustrated by the derivation (41).

On line 3, an additional \* will be added to *huis* by convention because at that level both constituents should be represented.

Verbal compounding is unproductive in Dutch. A verbal compound like *stofzuigen* '(lit.) to dust-suck', i.e., 'to vacuum clean' has probably arisen through reinterpretation: the regular nominal compound [*stof*]<sub>N</sub>[*zuiger*]<sub>N</sub><sub>N</sub> 'vacuum cleaner' with the de-verbal head *zuiger* can have been reinterpreted as the de-verbal *-er*-noun of the verbal stem *stofzuig*.<sup>28</sup> Prosodically, they fall

<sup>27</sup> Some speakers of Dutch have regular main stress on this compound: *kinderbijslag*.

<sup>28</sup> Cf. Booij (1989b) for a more elaborate analysis of these phenomena.

(41)	[[{oude}] <sub>A</sub>	[{mannen}] <sub>N</sub> <sub>NP</sub>	[{huis}] <sub>N</sub> <sub>N</sub>	
1st cycle: MSR	*	*	*	line 1
	<u>*</u>	<u>*</u>	<u>*</u>	line 2
2nd cycle: NSR		*		line 3
3rd cycle: CSR		*	*	line 3
		*		line 4

under the domain of the CSR that correctly predicts main stress on the first constituent.

Adjectival compounds exhibit two different stress patterns. Most of them have main stress on the second constituent (Visch 1989: 105, Trommelen and Zonneveld 1989a: 246, Backhuys 1989):

(42) *hulpbehoevend* '(lit.) help-needing'

*gastvrij* 'hospitable'

*zelfrijzend* 'self-raising'

*kiesgeréchtigd* 'enfranchised'

*doofstom* 'deaf-mute'

However, in attributive position there is stress shift (Iambic Reversal) to the first constituent, as in *een gástvrije ontvangst* 'a warm welcome' (cf. Section 7.4). A minimal pair illustrating the difference with nominal compounds is *taalpolitiek* (noun) 'language policy' versus *taalpolitiek* (adj.) 'language-political'.

A second class of complex adjectives has main stress on the first prosodic words, that is, the strong-weak pattern (Backhuys 1989):

(43) *zéeziek* 'sea-sick'

*schietgraag* 'trigger-happy'

*zínvol* 'meaningful'

*lévensmoe* 'world-weary'

*kléurrijk* 'colourful'

Formally, the right constituents are adjectival heads, but semantically they are comparable to adjectival suffixes, since their lexical meaning has faded. Indeed, they have the same stress pattern as complex adjectives such as *kléurloos* 'colourless' and *vrúchtbaar* 'fruitful'. In other words, these adjectives fall under the general CSR.

The following type of adjective has been claimed to form a special category:

(44) [{ree}]<sub>N</sub>[bruin]<sub>A</sub> |<sub>A</sub> '(lit.) deer brown', i.e., 'fawn coloured'

[{peper}]<sub>N</sub>[duur]<sub>A</sub> |<sub>A</sub> '(lit.) pepper-expensive', i.e., 'very expensive'

[{reuze}]<sub>N</sub>[leuk]<sub>A</sub> |<sub>A</sub> '(lit.) giant funny', i.e., 'very funny'

[{knetter}]<sub>V</sub>[gek]<sub>A</sub> |<sub>A</sub> '(lit.) crackling mad', i.e., 'completely mad'

[{geel}]<sub>A</sub>[groen]<sub>A</sub> |<sub>A</sub> 'yellow-green'

[{aarts}]<sub>A</sub>[lelijk]<sub>A</sub> |<sub>A</sub> 'very ugly'

Van Heuven (1986: 84; 1987) showed for bisyllabic adjectival compounds that although the focused constituent is indeed accented, as in *Zij is een bééldschoon meisje* 'She is a very beautiful girl', the intensity and duration of the two constituents are more alike than in the case of simplex bisyllabic adjectives such as *concreet* 'concrete'. That is, they seem to be equally stressed. Neijt (1990), in a reaction, argued that these adjectives fall under the weak-strong patterns, and that durational rules may account for the similarity in duration of the two syllables.<sup>29</sup> Spoken in isolation, a word like *beeldschoon* does have accent on the final syllable in the form of a down-stepped tone.

Compound prepositions also fall under the weak-strong pattern, when they are used intransitively. When they form part of a prepositional phrase, the main stress shifts to the first constituent:

- (45) *bovenín*            *bóvenin de kàmer* 'at the top of the room'  
       *onderáan*        *ónderaan de bèrg* 'at the foot of the mountain'  
       *bovenóp*        *bóvenop het dàk* 'on top of the roof'  
       *achteráan*       *áchteraan de rìj* 'at the back of the row'

In sum, adjectival and prepositional compounds are exceptions to the CSR in that they have the reverse stress pattern weak-strong. However, this only applies to adjectives of which the head still has a distinct lexical meaning.

## 5.5. STRESS IN PREFIXED WORDS

### 5.5.1. Non-native prefixes

Dutch has a number of non-native prefixes which attach to non-native base words or to roots that do not always occur as words by themselves:

- (46) a-            *apathisch* 'apathetic'  
       ab-          *absorbeer* 'to absorb'  
       ad-          *adhesie* 'adhesion'  
       ante-        *antedateer* 'to predate'  
       apo-        *apotheose* 'apothecosis'  
       con-        *concentreer* 'to concentrate'  
       de-        *decomponeer* 'to decompose'  
       in-        *inclusief* 'inclusive'  
       inter-      *intervenier* 'to intervene'  
       per-        *perforeer* 'to perforate'  
       post-      *postdateer* 'to postdate'  
       pre-        *prelude* 'id.'  
       re-        *representeer* 'to represent'  
       trans-     *transponeer* 'to transpose'

<sup>29</sup> Cf. Sluijter (1992) for further comments on this issue.

As we have seen in Section 3.6, prefixes are independent domains of syllabification. However, non-native prefixes may lose their transparency, and thus become one prosodic word with the stem. This is illustrated by the verb *reageer* 'to react' in which Homorganic Glide Insertion applies obligatorily. It may also be illustrated by the possible syllabification pattern  $(\text{tran})_{\sigma}(\text{spo})_{\sigma}(\text{neer})_{\sigma}$  for the verb *transponeer*.<sup>30</sup> In terms of secondary-stress patterns they often seem to form one domain with their verbal stem, because they get secondary stress (they will never bear main stress given the fact that the MSR basically assigns stress to one of the word-final syllables):

- (47) *datéer*                      *àntèdatéer*  
       *còmponéer*                *dècòmponéer*  
       *prèsentéer*               *rèprésentéer*  
       *ponéer*                    *trànsponeer*

For instance, in *representeer* the first syllable bears secondary stress. Hence, reduction of the vowel of the first syllable is impossible, unlike that of *re-* in *réductie* 'reduction':

- (48) *representeer*            [represente:r], [reprəsente:r], [reprəsənte:r],  
                                       \*[rəprəsənte:r]  
       *reductie*                    [redyksi], [rədyksi]

In other cases, for instance the verb *reanimeer* /re-animer/ 'to reanimate', the prefix may still be recognized because of the transparent meaning of *re-* in this case: there exists an independent word *animeer* 'to animate'. In any case, non-native prefixes do not get primary stress, but at most secondary stress, either by virtue of being a prosodic word of their own, or because they are in the domain of the Optimal Grid Rule. The rule that states that prefixes in complex verbs do not bear main stress will be given below. Prefixed words of other lexical categories such as *prelude* will be considered as simplex words, just like prefixed verbs that have lost their transparency, and hence they are stressed by the MSR.

### 5.5.2. Nativized and native prefixes

Some originally non-native prefixes have become native in that they also attach to native base words, unlike the non-native prefixes discussed above, and sometimes they even occur as independent words, for instance *anti-*, *co-*, *contra-*, *des-*, *ex-*, *inter-*, *meta-*, *non-*, *para-*, *pro-*, *semi-*, *sub-*, *super-*, *ultra-*. That is, they behave like compounds, and also get the stress pattern of compounds that is derived by the CSR. In many examples given here the

<sup>30</sup> Another example is the phonetic realization of *abortus* 'abortion'. Usually, the prefix *ab-* will no longer be recognized here. Those who still recognize the prefix will pronounce this word as  $(\text{ap})_{\sigma}(\text{ɔr})_{\sigma}(\text{tʃs})_{\sigma}$ , but most speakers pronounce it as  $(\text{a})_{\sigma}(\text{bɔr})_{\sigma}(\text{tʃs})_{\sigma}$ .

right constituent is a native word. The right constituent (the head) is a noun, and the syntactic category of the whole word is therefore predictable:

- (49) *ánti*-houding 'adverse attitude'  
*có*-piloot 'co-pilot'  
*cón*tra-gewicht 'counterweight'  
*dés*-interesse 'disinterest'  
*éx*-gelovige 'ex-believer'  
*í*nter-faculteit 'inter-faculty'  
*mé*ta-taal 'metalanguage'  
*nón*-issue 'id.'  
*sé*mi-arts 'assistant doctor'  
*súb*-groep 'sub group'  
*sú*per-markt 'supermarket'

All these prefixes are independent prosodic words, and thus such prefixed words are subject to the CSR.

Adjectives with such prefixes pattern differently in that, like, for example, adjectives prefixed with *on-* (see below), they have main stress on the adjectival head when they occur in predicative position (Langeweg 1986):

- (50) *inter*-continentaal 'intercontinental'  
*para*-médisch 'paramedical'  
*post*-koloniiaal 'postcolonial'  
*semi*-diréct 'id.'  
*ultra*-modérn 'id.'

Within the set of native prefixes we have to distinguish two classes. Some of them get main stress. They should be considered independent prosodic words since they contain full vowels, have an internal stress pattern when they are polysyllabic, form an independent domain of syllabification, and one of them, *aarts-* 'arch-' even has an appendix of two coronal obstruents, which is only possible if it is a prosodic word. These prefixes attach to nouns, and the syntactic category of the complex word is always that of the base word:

- |                           |   |
|---------------------------|---|
| (51) <i>aarts-</i> /arts/ | <i>á</i> artsbisschop 'archbishop'      |
|                           | <i>á</i> artsvader 'patriarch'          |
| <i>oer-</i> /ur/          | <i>ó</i> ermens 'primitive man'         |
|                           | <i>ó</i> erwoud 'primeval forest'       |
| <i>on-</i> /ɔn/           | <i>ón</i> mens 'brute'                  |
|                           | <i>ón</i> zin 'nonsense'                |
| <i>her-</i> /hɛr/         | <i>hér</i> bouw 'rebuilding'            |
|                           | <i>hér</i> financiering 'refinancing'   |
| <i>onder-</i> /ɔndər/     | <i>ó</i> nderverhuur 'to sublet'        |
|                           | <i>ó</i> nderbouw 'to underpin'         |
| <i>over</i> /ovər/        | <i>ó</i> vergang 'transition'           |
|                           | <i>ó</i> verbesteding 'excess spending' |



Since these prefixes are defined as independent domains of syllabification, and since they also fulfil the requirements for prosodic word status, words with these prefixes will be prosodic compounds, and thus subject to the CSR that correctly assigns primary stress to the first prosodic word of complex nouns, in these cases the prefix. So no special rule is required for the derivation of the stress patterns of words with these prefixes.

The second category of native prefixes is formed by those that are always stressless; they are all verbalizing prefixes:

- (52) be- /bə/      bedíjk 'to dike'  
 er- /ɛr/      erváar 'to experience'  
 ge- /ɣə/      gelóof 'to believe'  
 ont- /ɔnt/      ontmóet 'to meet'  
 ver- /vɛr/      vertróuw 'to trust'

As pointed out above, although they are independent domains of syllabification, those with schwa cannot form a prosodic word of their own.

There is a second category of unstressed verb-creating native prefixes, which also occur as prepositions or particles. They all fulfil the requirements for being a prosodic word, and for the bisyllabic ones, the location of the main stress is completely predictable because the second syllable contains a schwa. Since they have specific meanings when used as prefixes, I consider them as prefixes, not as the first parts of compounds. Thus, we can correlate their prefixal nature with the fact that they do not receive the main stress of the word, as we would expect if they were compounds:

- (53) aan- /an/      aanváard 'to accept'  
 achter- /axtər/      achterháal 'to recover'  
 door- /dor/      doorlóop 'to pass'  
 her- /hɛr/      herbóuw 'to rebuild'  
 mis- /mɪs/      misdráag 'to misconduct'  
 om- /ɔm/      omklém 'to grasp'  
 onder- /ɔndər/      onderstéun 'to support'  
 over- /ovər/      overstróom 'to overflow'  
 vol- /vɔl/      voldóen 'to suffice'  
 voor- /vor/      voorkóm 'to prevent'  
 weer- /vɛr/      weerspíegel 'to reflect'

So the rule that accounts for the stress pattern of these prefixed words is the following:

- (54) In prefixed verbs, assign \* on the next line to the rightmost prosodic word.

This rule will account for verbs with either native or non-native prefixes. It competes with the CSR in that it also applies to sequences of prosodic words. Since it is the more specific one, referring to the category 'prefixed verb'

whereas the CSR does not mention morphological information, it will get priority by the Elsewhere Principle.<sup>31</sup>

Finally, there are some prefixes with variable stress (Schultink 1964, De Vries 1975). The prefixes *her-*, *over-*, and *onder-* when used with verbal bases, follow the rule just given, unless the first syllable of the base verb does not bear main stress. In that case, the prefixes receive main stress:

(55)	<i>Base verb</i>	<i>Derived verb</i>
<i>her-</i>	formuléer	hérformuleer 'to reformulate'
<i>onder-</i>	financíer	ónderfinancier 'to underfinance'
<i>over-</i>	belícht	óverbelicht 'to overexpose'

According to the literature on Dutch stress, the negative prefix *-on* behaves in a marked fashion when attached to adjectival bases: either the prefix or the adjective bears main stress, depending on the syntactic position (Van den Berg 1970, Schultink 1979): in predicative position, main stress is either on the base or on the prefix. There appears to be variation here, at least in transparent adjectives: the main stress is on the adjective, but in order to emphasize the negative meaning, *on-* can also get main stress.<sup>32</sup> The prefix usually bears main stress in attributive position:

- (56) Jan is onáardig/ónaardig  
       'John is unkind'  
       een ónaardig mens  
       'an unkind person'

This also applies to adjectives with the prefixes *aarts-* and *oer-*, as in *aartslelijk* 'very ugly' and *oergezellig* 'very cosy'. The stress behaviour in attributive position can be interpreted as a case of Iambic Reversal, i.e., a case where stress clash is resolved by shifting stress to the left (cf. Chapter 7; at line 4, the rule for phrasal stress applies):

(57)	(on)	(aardig)	(mens)
line 1	*	*	*
line 2	*	*	*
line 3 CSR	←	⊗	*
line 4 (NSR)			*

## 5.6. BRACKETING PARADOXES

The analysis of stress given so far enables us to solve those 'bracketing paradoxes' (cf. Booij and Rubach 1984, Pesetsky 1985, Cohn 1989, Spencer

<sup>31</sup> This rule also illustrates the point made in Booij and Lieber (1993) that prosodic rules must be able to refer to morphological information.

<sup>32</sup> This does not apply to semantically opaque adjectives such as *ondeugend* 'naughty' which has no positive counterpart *deugend* 'virtuous'. In such cases, main stress is not on *-on*.

1991) which involve stress. The classic example is the English word *ungrammaticality*. I will discuss here its Dutch equivalent *ongrammaticaliteit*. The problem arises because a distinction between level-1 phonology and level-2 phonology is assumed which correlates with a difference between level-1 morphology (= non-native morphology) ordered before level-2 morphology (native). On this view, non-native morphology is stress-shifting because the MSR is restricted to level 1, and this explains that native morphology is stress-neutral. The paradox then is that from the morphological point of view *-iteit* is added to the adjective *ongrammaticaal*, whereas from the phonological point of view it seems that first *-iteit* is added to *grammaticaal*, thus causing shift of the main stress to the final syllable of *-iteit*, and then, at level 2, *on-* is added, which then has no effect on the location of main stress on the part *grammaticaliteit*. Thus, both of the following two structures seem to be necessary:

(58) Morphological structure: [ [on[grammaticaal]<sub>A</sub> ]<sub>A</sub>iteit]<sub>N</sub>

Phonological structure: [on| [grammaticaal]<sub>A</sub>iteit]<sub>N</sub> |<sub>N</sub>

In the analysis presented here and the preceding chapter, I do not make use of level ordering. The word *ongrammaticaliteit* clearly shows that non-native affixation (with *-iteit*) may follow native affixation (with *on-*), so the ordering of all non-native affixation before all native affixation is empirically inadequate.<sup>33</sup> Since in the adjective *ongrammaticaal* the base adjective *grammaticaal* is the head of the word, and since it bears the feature [−native], the whole adjective *ongrammaticaal* is [−native] by percolation (cf. Williams 1981), and thus attachment of the [−native] suffix *-iteit* is allowed. Note that we need a morphological principle that restricts [−native] suffixation to [−native] bases anyway, since we also have to exclude [−native] suffixation to [+native] roots: a word such as *\*roditeit* '(lit.) reddity i.e., 'redness' derived from the [+native] adjective *rood* is impossible.

Instead, the suffix *-iteit*, being a [−native] suffix, is predictably cyclic. Hence it will erase the existing stress pattern of *ongrammaticaal* (the Stress Erasure Convention), and induce reapplication of the MSR to the newly formed string *ongrammatikaliteit*, thus assigning main stress to the last syllable. Subsequently, the Optimal Grid Rule will assign secondary stress, which results in the stress pattern *òngrammàtikàlitéit*.<sup>34</sup>

As noted above, there are also [+native] suffixes that are nevertheless cyclic. This forms another problem for the theory of level ordering because they would be level 1 in terms of stress, but level 2 as far as morphology is concerned.

<sup>33</sup> See Booij (1982a) for more empirical evidence from Dutch.

<sup>34</sup> Arguments for the same analysis of the English equivalent *ungrammaticality* are given in Halle and Vergnaud (1987: 80–5). However, they also argue that all phonology follows all morphology, a claim I do not support.

## CONNECTED SPEECH I: WORD PHONOLOGY

### 6.1. INTRODUCTION

In the preceding chapters I have presented a survey of rules concerning the distribution of sounds within prosodic words. These rules of word phonology have an obligatory character (although some also apply optionally in larger domains). In connected speech, words are subject to rules which are often optional, in that they are dependent on style of speech and speech rate. These rules serve to reduce the articulatory efforts of the speaker, and to get a smooth transition from one segment to the next. Therefore, most of these processes are either reduction processes or assimilation processes. For instance, the realization of a vowel as a schwa requires less articulatory effort than the realization of a full vowel (Koopmans-van Beinum 1980). In addition, we also find cases where insertion or apparent insertion of a segment serves ease of articulation.

The use of these processes is often characteristic of less monitored, casual speech. It is characteristic of casual speech that ease of production gets priority over ease of perception, because speakers can only afford to give priority to ease of production in more informal situations.

It is not the case that all rules diminish articulatory efforts in the same direction. For instance, schwa epenthesis has the effect of breaking up non-homorganic consonant clusters (but increases the number of syllables to be pronounced), but there is also a process of schwa deletion that decreases the number of syllables, but creates consonant clusters.

Although the rules to be discussed here are usually optional, it may be that use of one makes use of another one obligatory, as will be shown below.

A related category of rules is formed by the rules that typically depend on speech rate. Examples are the rules of Schwa Deletion and /i/-deletion. The basic effects of such rules are that certain segments are either not pronounced, or 'masked' because they show temporal overlap due to decreased magnitude in space and time of the segments involved (Browman and Goldstein 1990). They may be called fast-speech rules, but without further empirical research it is impossible to decide whether there are rules which only depend on speech rate, and not on degree of monitoring as well.

Although casual speech may often be fast speech, the two notions are not identical (Zwicky 1972). One can speak casually at low speed, or one may not use the rules typical of casual speech, and yet speak fast (Nolan 1992: 264).

However, since casual speech and fast speech often go together, the actual use of a casual-speech rule may also exhibit the effects of higher speech rate, and it is not easy to distinguish between the two factors.

In addition to their being possibly optional, connected speech rules are also different from the obligatory rules of word phonology in that they may create types of syllable that are not allowed for by the lexical syllabification algorithm. This applies for instance to the rule of schwa deletion, and it is another reason for considering them as postlexical rules rather than as lexical rules, since the latter may not violate the lexical syllable-structure constraints.<sup>1</sup>

As pointed out above, the actual application of rules of connected speech is typically dependent on the style of speech (i.e., degree of monitoring) and/or speech rate. In addition, a number of other factors play a role:

- lexical variation: words with a higher frequency, that is, with a higher activation level in the lexical memory, are more often subject to such rules than words with a lower frequency;
- dialectal variation: rules may be applied differently depending on the geographical or social background of the speaker;
- the linguistic properties and environments of the segments involved; for instance, mid vowels reduce much more easily than high vowels, and more easily in open syllables than in closed syllables.

In other words, these rules are typically variable rules in the sense of Labov (1972).

Although the connected speech processes of Dutch are described here in categorical terms, they may be of a more gradual nature than these descriptions suggest. Phonologists base their inventories of connected speech processes on perception, which is inherently categorical, but such inventories are not more than a first necessary step in the unravelling of connected speech processes (Kohler 1990, 1991). For instance, the phonologist of Dutch perceives a vowel in unstressed position as either the full vowel or the schwa, but it may be that the actual vowel has been slightly reduced only, thus leading to its still being perceived as a full vowel, although some reduction has applied.

In this chapter I deal with connected speech phenomena that apply within words. The domains of these rules are prosodic constituents such as the coda, the syllable, or the prosodic word, hence they only apply within words. The next chapter covers reduction and assimilation processes that apply across (prosodic) word boundaries, and Chapter 8 deals with the phonological behaviour of clitics, another typical connected speech phenomenon.

<sup>1</sup> In other words, these rules are not always structure-preserving, which might be a reason for considering them as postlexical rules; cf. Kiparsky (1985).

## 6.2. SCHWA EPENTHESIS

In non-homorganic consonant clusters in coda position, a schwa may be inserted:

(1) kalm 'quiet'	[kʌləm]
arm 'id.'	[ʌrəm]
help 'id.'	[hɛləp]
harp 'id.'	[hʌrəp]
herfst 'autumn'	[hɛrəfst]
elf 'eleven'	[ɛləf]
melk 'milk'	[mɛlək]
werk 'work'	[vɛrək]
alg 'alga'	[ʌləx]
erg 'very'	[ɛrəx]
urn 'id.'	[ʏrən]
hoorn 'horn'	[hʊrən]

Schwa insertion is impossible if the second of the two consonants involved is an appendix consonant, that is, /s/ or /t/, or if the cluster is a nasal followed by a homorganic consonant:

- (2) a. hart 'heart' \*[hʌrət], hars 'resin' \*[hʌrəs], markt 'market' [mʌrəkt],  
but \*[mʌrkət], halt 'stop' \*[hʌlət], band 'tape' \*[bʌnət], hals  
'neck' \*[hʌləs], kans 'chance' \*[kʌnəs]  
b. damp 'id.' \*[dʌməp], bank 'id.' \*[bʌŋək]

These facts suggest the following rule of Schwa Epenthesis:<sup>2</sup>

## (3) Schwa Epenthesis

Insert ə in



This rule will not apply to clusters with coronal obstruents because these are syllabified as appendices. This supports the 'active' interpretation of the Appendix position: even in a word like *hart* 'heart', the /t/ must be considered as an appendix although this is not required by the length of the rhyme. Homorganic clusters of a nasal plus obstruents form partial geminates: they share the features on the Place tier. Indeed they show the property typical of geminates, integrity: the two halves cannot be separated by a vowel. Note, however, that insertion of a schwa is not blocked here by the prohibition on crossing association lines since the schwa has no Place tier at the underlying level. So the following configuration could arise:<sup>3</sup>

<sup>2</sup> This process is discussed in Booij (1981a: 156), Berendsen and Zonneveld (1984), and De Haas (1986).

<sup>3</sup> The consequence of treating the epenthetic vowel as an underspecified vowel, i.e. the impossibility of using the Prohibition on Crossing of Association Lines as a blocking mechanism in this case, was pointed out by Levin (1985: 87–8). The analysis in De Haas (1986) makes use of this condition, and therefore Levin's objection applies to that analysis.

(4) [+cons] [-cons]<sub>u</sub> [+cons]

Place

Let us therefore assume the following condition on linking: 'Consonants that share their melodic specifications partially or wholly must be adjacent on the X-tier'.<sup>4</sup> This rules out the above configuration, and thus schwa-epenthesis is blocked.

In words like *kern* /kɛrn/ 'core' and *urn* /yɾn/ 'id.', the two coda consonants do not share their Place features, unlike nasal-stop clusters, and hence schwa insertion does take place in these cases.

The fact that the rule also applies to words like *toorn* 'anger' and *hoorn* 'horn' proves that the final /n/s in these extra-long syllables should not be seen as (exceptional) appendix consonants, but as the last consonant of exceptionally long codas. Underlyingly, there is no schwa in these words, and we have minimal pairs such as *toorn* /torn/ 'anger'—*toren* /torən/ 'tower', *hoorn* /horn/ 'horn'—*horen* /horən/ 'to hear'.<sup>5</sup>

Finally, note that schwas cannot be inserted in word-final obstruent clusters such as /sp/ and /sk/, as in *wesp* 'wasp' and in the suffix *-esk*. This implies that we require the first consonant to be sonorant, or that we treat the special clusters /sp/ and /sk/ as a kind of complex segment (cf. Ewen 1982), linked to one X on the X-tier.

From a functional point of view it is quite natural that only heterorganic consonant clusters are broken up since they require more articulatory effort than homorganic clusters.

### 6.3. SCHWA DELETION

When a Dutch word has two consecutive syllables headed by schwa, the first of these schwas may be deleted, provided that the resulting onset consonant cluster be an obstruent + liquid cluster, universally the most favoured type

<sup>4</sup> This suggestion was made by John McCarthy (personal communication). Note that this condition is restricted here to consonants which indeed usually exhibit local types of assimilation, whereas vowels can influence each other across consonants (e.g. Umlaut, vowel harmony), as observed in Clements (1985). There are a few exceptions though, like the Sanskrit Nati rule that makes a nasal retroflex if a retroflex consonant precedes it. There may be other segments between the consonants involved, but no coronal consonants (Schein and Steriade 1986). Therefore, Clements and Hume (1993) proposed a different analysis in which non-adjacent consonants can share single features, but non-adjacent consonants are blocked from sharing class nodes since vowels have the same class nodes.

<sup>5</sup> There are southern and western dialects of Dutch in which schwas in this configuration appear to be underlying, since they also have the schwa in heterosyllabic clusters as in *werken* 'to work' [wɛrəkən] (cf. Berendsen and Zonneveld 1984).

of onset cluster. In the examples below the schwa that deletes is represented by *e*.

(5) soepele 'smooth'	[suplə]
koperen 'copper'	[kopɾən]
knabbelen 'to munch'	[knablən]
bibberen 'to tremble'	[bɪbrən]
snuffelen 'to search'	[snɪflən]
offeren 'to sacrifice'	[ɔfrən]
hevelen 'to syphon'	[hevlən]
kietelen 'to tickle'	[kitlən]
wandelen 'to walk'	[wəndlən]
wisselen 'to change'	[wislən]
mazelen 'pimps'	[mazlən]
gemakkelijk 'easy'	[ɣəmuklək]
rochelen 'to hawk up'	[rɔxlən]
kegelen 'to play skittles'	[keɣlən]

What is remarkable here is that /tɪ/, /dɪ/, and /zɪ/ form onsets. Universally, they are permitted, but in Dutch they do not occur at the lexical level, as shown in Section 3.5.2. In the case of /dɪ/ and /zɪ/, the intuitive syllabification of these clusters as onsets is also proven by the fact that the /d/ and the /z/ do not devoice. The rule involved here should therefore not only express the deletion of the schwa and the configuration in which this is possible, but also that the pre-schwa consonant forms an onset with the following consonant. Note, moreover, that the rule does not apply to other configurations, even if they resulted in syllabifiable (but not always tautosyllabic) clusters:

(6) tekenen /tekənən/ 'to draw'	*[teknən]
bezemen /bezəmən/ 'to sweep'	*[bezmən]/*[besmən]
redenen /redənən/ 'reasons'	*[rednən]/*[retnən]
rammelen /rumələn/ 'to rattle'	*[rumlən]

Therefore, this process has to be interpreted as a rule that forms obstruent-liquid clusters across the schwa, whereby the schwa deletes:

(7) Schwa Deletion

Delete ə in the context [–son] ——— [–voc]  
[+appr]

This rule deletes the schwa of the first relevant syllable. Hence, that syllable node is no longer headed by a [–consonant] segment, and will disappear by convention. Thus, resyllabification of the original onset obstruent to the next onset is possible. This relinking is in accordance with the universal conditions on onsets (the SSG), but not with the language-specific constraints of Dutch that forbid /tɪ-, dɪ-, zɪ-/. So we might assume that language-specific constraints on syllable structure are turned off at the postlexical level.



Note that a schwa does not delete if the next syllable is headed by a full vowel:<sup>6</sup>

- |  |           |
|--|-----------|
| (8) <i>geraamte</i> /ɣəramtə/ 'skeleton' | *[ɣramtə] |
| <i>beloven</i> /bəlovən/ 'to promise'    | *[blovən] |
| <i>beraad</i> /bərad/ 'meeting'          | *[brat]   |

The rule decreases the articulatory effort required for the pronunciation of the relevant words in that there is one syllable less to produce. Admittedly, consonant clusters are created but this kind of consonant cluster, obstruent + liquid, is the universally favoured kind of CC-onset, and may therefore be assumed to be relatively simply to produce.

#### 6.4. VOWEL REDUCTION

Vowel reduction is the phenomenon that an underlyingly full vowel is optionally realized as schwa in unstressed syllables.<sup>7</sup> The following examples illustrate this process:

- |                                    |         |
|------------------------------------|---------|
| (9) <i>banáan</i> /banan/ 'banana' | [bənan] |
| <i>lokáal</i> /lokal/ 'class-room' | [ləkal] |
| <i>metáal</i> /metal/ 'metal'      | [mətal] |
| <i>muzék</i> /myzik/ 'music'       | [məzik] |
| <i>minúut</i> /minyt/ 'minute'     | [mənyt] |

Vowel reduction is subject to a number of conditions. It should first be noted that speakers vary somewhat as to the vowel reductions they allow for. Furthermore, there is a strong frequency effect in that words with high frequency reduce much more easily. High vowels do not reduce easily: for instance, reduction of the first vowels of *Liane* 'id.' /lianə/ and *Suzanne* 'id.' /syzənə/ is almost impossible: \*[ləjanə], \*[səzənə]. Yet, the unstressed vowels in *minúut* and *muziek* reduce reasonably easily, because they are high frequency words that are often used in casual speech.<sup>8</sup>

Reduction is even easier when the vowel is in interstress position. So the combined effects of frequency and position makes the reduction of the high vowels in the following examples quite natural:

- |                                       |            |
|---------------------------------------|------------|
| (10) <i>dóminèe</i> /domine/ 'parson' | [doməne]   |
| <i>àspiríne</i> /aspirinə/ 'aspirin'  | [əspərinə] |
| <i>lúcifèr</i> /lysifər/ 'match'      | [lysəfər]  |

<sup>6</sup> Certain lexicalized cases are exceptions, such as *geloven* [ɣlovən] 'to believe', *gereformeed* [ɣrɛfɔrmɛ:t] 'reformed, Protestant', *terug* [trɪx], and *terecht* [trɛxt] 'rightly'. Moreover, some native speakers also delete schwas in syllables which are followed by syllables with primary or secondary stress in other words, as in *apparáat* /aparət/ [uprat] 'apparatus' (Schwa Deletion is applicable after vowel reduction of the unstressed /a/), *kapeláan* /kəpələn/ [kuplan] 'chaplain' and *koppeling* /kəpəlɪŋ/ [kɔplɪŋ] 'coupling'. High frequency of words is an additional factor here.

<sup>7</sup> Cf. Martin (1968), Booij (1977, 1981a, 1982b), and Kager (1989).

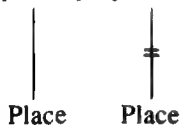
<sup>8</sup> In Fidelholtz (1975) the importance of frequency and the reluctance of high vowels to reduce is pointed out with respect to English.

(11) anáal 'anal'	*[ənal]
elíte 'élite'	*[əlité]
erótisch 'erotic'	*[ərotis]
maoíst 'Maoist'	*[maəíst]
heráut 'herald'	*[hərcəut]
heróisch 'heroic'	*[hərovis]
humáan 'human'	*[həman]

(12)	syllábe /silabə/ 'syllable'	[səlabə]
	misschén /mɪsxɪn/ 'perhaps'	[mæsxɪn]
	suppórtər /sɹɔpɔrtər/ 'id.'	[səpɔrtər]
	dessért /dæsɛrt/ 'id.'	[dæsɛrt]
	rappórt /rəpɔrt/ 'report'	[rəpɔrt]

(13) pleidóoi /plɛidoj/ 'plea' \* [plædoj]  
seizóen /sɛizun/ 'season' \* [səzun]  
Paulíen /pɔulin/ 'Pauline' \* [pəlin]

(14) Vowel Reduction  
[+cons] [-cons] X )<sub>σ</sub> Y)<sub>ω</sub>



**X =  $\emptyset$  or [+cons], Y  $\neq \emptyset$ ,  $\sigma$  is unstressed**

The rule will not apply to diphthongs, as required, because diphthongs are

<sup>9</sup> Examples from Kager (1989: 306).

sequences of [-cons] segments, and hence do not satisfy the structural description of the rule.

As pointed out in the relevant literature, there are cases in which vowel reduction takes place in closed syllables. In word-initial position this is particularly clear for the sequence /ɛr/, and also for short vowels followed by /s/:

(15) <i>persón</i> /person/ 'person'	[pəɾsɔn]
<i>percént</i> /persɛnt/ 'per cent'	[pəɾsɛnt]
<i>pastóor</i> /pastor/ 'pastor'	[pəsto:r]
<i>pastéi</i> /pastei/ 'pie'	[pəstei]

As pointed out by Koopmans-van Beinum (1982), the /r/ has a centralizing effect, and will thus further reduction of a vowel to the central vowel schwa. In other cases, intuitions differ. In my idiolect, I have to delete the consonant first before being able to reduce the vowel. In that way, the vowel becomes reducible, being in syllable-final position:

(16) <i>benzíne</i> /benzinə/ 'petrol'	[bəzinə], *[bənzinə]
<i>kantón</i> /kantɔn/ 'canton'	[kəɾɔn], *[kəntɔn]
<i>portíer</i> /pɔrtir/ 'porter'	[pəti:r], *[pərti:r]
<i>kwartíer</i> /kʷartir/ 'quarter'	[kʷəti:r], *[kʷərti:r]

Other native speakers of Dutch (cf. Kager 1989) allow for the phonetic forms starred here by me. We also observe here the interdependency of optional rules: once the syllable-final consonant has been dropped, the vowel must reduce. In other words, phonetic forms like [bəzinə], [pəti:r] and [kəɾɔn] are impossible. Once we have chosen a certain style of speech, the rules become obligatory within that style of speech (Booij 1981a: 149ff.): the use of one rule implies use of the other.<sup>10</sup> In any case, the exceptional types of closed syllables in which reduction is allowed can be specified as an alternative condition on the variable X mentioned in the rule. The conditions on X observed so far that will further vowel reduction are: in word-initial syllables, if X = /r/ preceded by ɛ, or X = /s/.<sup>11</sup> Such variable furthering conditions are characteristic of style-governed, optional rules, as shown by Labov (1972).

As observed in Booij (1981a: 149) and Kager (1989: 282), closed syllables in word-internal position allow for vowel reduction on a much larger scale (the reducible vowels are in *italic*):

(17) <i>identfiek</i> 'identical'
<i>compensátie</i> 'compensation'
<i>anekdoté</i> 'anecdote'
<i>directéur</i> 'director'
<i>aliméntátie</i> 'alimony'

<sup>10</sup> This has also been observed by Kučera (1973) for Czech and by Hooper (1976) for English.

<sup>11</sup> The positive effect of /s/ may have to do with the fact that /s/ can easily become onset of the following syllable, so that the vowel to be reduced is in syllable-final position.

sentimentéel 'sentimental'  
 paviljoen 'pavilion'  
 infiltréer 'to infiltrate'  
 amalgaam 'amalgam'  
 adoptéer 'to adopt'

This suggests that for a vowel to be in a word-internal position furthers its reduction whatever the value of X.

Many of the examples given concern /e/. This is no coincidence: the /e/ appears to be the vowel that is most susceptible to reduction, to such an extent that in many words the underlying /e/ has been replaced with /ə/ (cf. Booij 1982*b*). For instance, the first vowel of *Rebecca* 'id.' is always pronounced as a schwa. Consequently, the schwa may also surface in syllables where the Optimal Grid Rule would have assigned secondary stress if the syllable contained a full vowel /e/, as in *reformatie* 'reformation' [rəfərmatsi] and *revolutie* 'revolution' [rəvolytsi]. In other words, in many cases a historical /e/ has been replaced with a schwa in the underlying form.<sup>12</sup> In some pairs of related words, the /e/ alternates obligatorily with schwa, as in

- |                       |                            |
|-----------------------|----------------------------|
| (18) juwéel 'jewel'   | [jyvel]                    |
| juwélfer 'jeweller'   | [jyvəli:r], *[jyveli:r]    |
| gené 'genius'         | [zjəni], *[zjeni]          |
| geniaál 'genial'      | [ɣənijal], *[ɣənijal]      |
| miníster 'minister'   | [minɪstər], *[minɪster]    |
| ministérie 'ministry' | [minɪsteri] or [minəsteri] |

The fact that the schwas are obligatory here also illustrates that some schwas have become part of the underlying form of certain allomorphs, since there is no regular alternation involved.

A factor that might play a role in the lack of reducibility of /i/ in suffixes like *-iteit* '-ity' and *-iseer* '-ize' is that in these cases the /i/ is located at morphological boundaries which appear to impede reduction processes (Labov 1972).

Let us now look at some cases which are more complicated in that there are two syllables that are potentially subject to vowel reduction, words of the following type:

- (19) fònologie 'phonology'  
 ìndividú 'individual'  
 rèparatéur 'repairer'

In these words both the second and the third syllable are unstressed, and both unstressed syllables have the same vowel. Yet, as observed in Booij (1981*a*: 148) there is a clear preference to reduce the first unstressed syllable. This difference must have a structural explanation since the two vowels involved are the same. In other words, it cannot be attributed to a difference in

<sup>12</sup> Native speakers might also differ here as to whether they still have two possibilities, full vowel or schwa, or schwa only.

\*

	<i>Adjunct position</i>	<i>Stray position</i>
/e/	style III	style III
/a/	style II	style II
/o,i/	style II	style I
/y,u/	style I	excluded

The use of a style which is lower on the degree of formality implies that the reductions allowed for in styles which are more formal also apply (Dressler 1974, Booij 1981a: 150). So we predict the following possible phonetic realizations for a number of crucial cases (in order of increasing informality):

- (25) *èconomíe* /ekonomi/ 'economy': [ekonomi], [ekənomi], [ekənəmi],  
 \*[ekonəmi]  
*àdrenalíne* /adrenalinə/ 'adrenalin': [adrenalinə], [adrənalinə],  
 [adrənəlinə], \*[adrenəlinə]  
*lògopedíe* /loɣopedi/ 'speech therapy': [loɣopedi], [loɣopədi],  
 [loɣəpədi], \*[loɣəpedi]  
*grammátika* /ɣrumatika/ 'grammar': [ɣrumatika], [ɣrəmatika],  
 [ɣrəmatəka], \*[ɣrumatəka]

Usually, vowel reduction does not take place in final syllables. There are, however, some exceptions, in particular words ending in vowel + /r/, and words ending in /l, ɛ/ + consonant:

- (26) *mótor* /motər/ 'engine' [motər]  
*kérmis* /kɛrmis/ 'fair' [kɛrməs]  
*kénnis* /kɛn+nɪs/ 'acquaintance' [kɛnəs]  
*kóning* /konɪŋ/ 'king' [konɪŋ]  
*mónnik* /mɒnik/ 'monk' [mɒnək]  
*ídem* /idəm/ 'id.' [idəm]  
*Ágnes* /axnəs/ 'id.' [axnəs]  
*ámen* /amən/ 'id.' [amən]

In other words, the condition that the variable Y in the rule of Vowel Reduction be non-zero must be relaxed in that Y can be zero if X is a consonant and is preceded by /ɛ, ɪ/, or if X is /r/. In words historically ending in unstressed /ɛr/, the /ɛ/ is always realized as a schwa, so it must be assumed to be present underlyingly, as in *pater* 'father' (religious) [patər]. This lexical replacement of /ɛ/ through schwa can also be observed when stress shift makes a syllable with /ɛ/ unstressed, as in the following examples:

- (27) *normálitèr* /nɔrmalitɛr/  
*nòrmalíter* /nɔrmalitər/  
*negéren* /neyɛrən/ 'to ignore' [neyɛ:rən] or [nəyɛ:rən]  
*négeren* /neyɔrən/ 'to ignore, (lit.) to treat as a negro'

In the first word, the stress shift is a case of regularization (penultimate is the regular pattern), the change in the second word is a case of folk etymology: people interpret this verb as a conversion of the noun *negər* /neyɔr/ 'negro'.

We should also be aware of the fact that, since there is no special letter for the schwa, the schwa is mostly represented by *e*, which will induce native speakers to interpret the *e* as a schwa anyway.

## 6.5. VOWEL SHORTENING

Vowels can be shortened in word-initial position under the condition that the syllable in which they occur does not bear the main stress of the word. That is, secondary stress does not block the shortening:

- (28) /a-ɑ/      pàrادیjs 'paradise'  
                     àmalgáam 'amalgam'  
                     ànalýse 'analysis'  
                     Amérikà 'America'  
                     banáan 'banana'
- /e-ɪ/      tèlevísié 'television'  
                     tèlefóon 'telephone'  
                     g(e)rèforméerd 'reformed'<sup>1,3</sup>  
                     rèdenéer 'to reason'
- /o-ɔ/      kòlossáal 'enormous'  
                     pòlitiek 'politics'
- /j-i-ɪ/      dìrektéur 'director'

Except for /a/ the relevant vowels can only be reduced if they head the first syllable of a word-initial foot with its weak syllable being headed by schwa. In other words, reduction of the second syllable is required, except in the case of /a/:

- (29) analyse 'analysis': [analizə], [ʌnalize], [ʌnəlize]  
 televisie 'television': [televizi], [teləvizi], [tɪləvizi], \*[tɪləvizi]  
 politiek 'politics': [politik], [pəlɛtik], \*[pəlɛtik]  
 monument 'monument': [monymənt], \*[mɔnymənt], \*[mɔnɛmənt]

In *televisie* and *politiek* the first vowel can be shortened if the second vowel is realized as schwa; in *monument* the first vowel cannot be shortened because the second (high) vowel does not reduce to schwa.

The rule can be interpreted as a rule that deletes X in word-initial syllables. By requiring it to be followed by a consonant, reduction of the first vowel in a word like *chaotisch* /xaotis/ 'chaotic' is correctly blocked:

- ### (30) Vowel Shortening

Delete X in the context

$$\omega(\sigma(Q \mid X - X))$$

$$\begin{array}{cc} | & | \\ [\neg\text{cons}] & [+cons] \end{array}$$

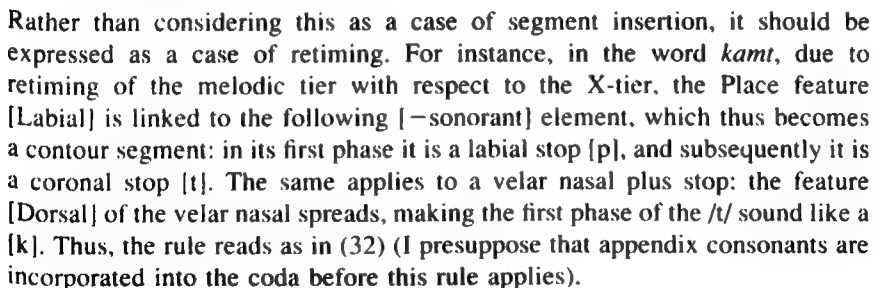
where Q stands for zero or more consonants

**Condition:**

$\sigma$  does not bear main stress; if it is not headed by /a/, it forms part of a binary foot with a weak  $\sigma$  headed by a schwa.

<sup>14</sup> As pointed out above, the first schwa of this word which is represented by the parenthesized *e* will have to be deleted as well in order to make the shortening possible.

The rule of Vowel Shortening is related to the rule of Vowel Reduction in that application of Vowel Reduction feeds application of Vowel Shortening, as illustrated above in (29).





## 6.7. /i/-DELETION

An unstressed /i/ optionally deletes between a consonant and the palatal glide /j/ (itself inserted by Homorganic Glide Insertion):

(33) station /station/ 'station'	[stasjɔn] <sup>14</sup>
rationeel /rationel/ 'rational'	[rasjonel]
financieel /finansiel/ 'financial'	[finansjel]
sociaal /sosial/ 'social'	[sosjal]
religieus /religiøs/ 'religious'	[reliɣjøs]
piano /piano/ 'id.'	[pjano]
ambiance /umbiãsə/ 'id.'	[ambjãsə]
ideaal /ideal/ 'ideal'	[idijal or [idjal] <sup>15</sup>
radioloog 'radiologist'	[radjoloχ]
lineaal 'ruler'	[linjal]
Ariane 'id.'	[arjanə]
alliantie 'alliance'	[aljantɕi]

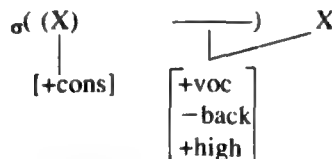
The stress condition correctly predicts that the /i/ does not delete in *Siam* /siam/ 'id.' or in *Siamees* /siames/ 'Siamese'. If the main stress precedes the syllable with /i/, there is also no deletion. For instance, deletion cannot take place in *pária* /paria/ 'pariah' \*[parja] or *Ázie* /aziə/ 'Asia' \*[azjə] (compare *Áziatisch* /aziatis/ 'Asian' in which, after glide insertion, deletion of /i/ can take place: [azjatis]).

When the preceding consonant is /s/, application of the rule is more probable, corresponding with the fact that of the resulting complex onsets only /sj/ is a completely regular onset at the lexical level, and can moreover be pronounced as one segment, a postalveolar [ʃ].

Deletion of /i/ does not occur when it is preceded by a complex onset. For instance, in *Adrianus* /adrianys/ 'id.' it is impossible to get the phonetic form [adrjanys], presumably because this would create a too complex onset, /drj-/.

The rule can therefore be formulated as (34).

(34) /i/-deletion: delete X X in the structure



Condition:

σ is unstressed, and is not preceded by main stress.

<sup>14</sup> The first vowel [a] may also be realized as [ɑ], in accordance with the rule of Vowel Shortening given above.

<sup>15</sup> Before /a/ the /e/ can be realized as an [i]; see also *lineaal* 'ruler' [linijal] and *areaal* 'area' [arijal].

The fact that the deletion only takes place in unstressed syllables, which have the shortest duration of all syllables, complies with a retiming interpretation of this phenomenon: it is only the X-tier that is changed.

For many speakers, realization of the word *station* /station/ 'id.' with deletion of the /i/ is the only possible pronunciation: [stasjən] or [statsjən], not \*[stasijən] or \*[stasijən].

## 6.8. /n/-DELETION

In standard Dutch, syllable-final /n/s can be dropped after a schwa, except in the indefinite article *een* /ən/ 'a':

## (35) Singular nouns

regen /reɣən/ 'rain'	[reɣən] or [reɣə]
molen /molən/ 'mill'	[molən] or [molə]
deken /dekən/ 'blanket'	[dekən] or [dekə]

## Plural nouns

bloem-en /blum-ən/ 'flowers'	[blumən] or [blumə]
plant-en /plʌnt-ən/ 'plants'	[plʌntən] or [plʌntə]
boek-en /buk-ən/ 'books'	[bukən] or [bukə]

## Plural verbs / infinitives

lopen /lop-ən/ 'to walk' (pres. pl./inf.)	[lopən] or [lopə]
eten /et-ən/ 'to eat' (pres. pl./inf.)	[etən] or [etə]

It is sometimes assumed that for those speakers who always drop the final /n/ of the plural morpheme *-en* /ən/ of verbs and nouns, the underlying form of the plural suffix is /ə/ instead. However, in Chapter 8 it will be shown that even for those speakers an underlying form /ən/ is required in order to explain why the final schwa of the past-tense suffix may disappear before a schwa-initial clitic through Prevocalic Schwa Deletion, but the schwa of the plural suffix cannot. For instance, *zette het* /zɛtə ət/ 'put (past sg.) it' can be pronounced as [zɛtət], whereas *zetten het* /zɛtən ət/ 'put (pres. pl.) it' is pronounced as [zɛtənət], and [zɛtət] is impossible in that case. This can only be accounted for if the underlying form of the plural morpheme ends in an /n/.

The /n/ can also be deleted at the end of syllables of other lexical categories such as adjectives and particles/prepositions:

(36) gouden /ɣɔudən/ 'golden'	[ɣɔudə]
open /opən/ 'id.'	[opə]
boven /bovən/ 'above, upstairs'	[bovə]

Examples of word-internal /n/-deletion are diminutives with a base noun ending in *-en*, and some adverbials:<sup>16</sup>

- |   |             |
|---|-------------|
| (37) <i>kuikentje</i> /kœykən-tjə/ 'chicken' (dimin.) | [kœykətjə]  |
| <i>molentje</i> /molən-tjə/ 'mill' (dimin.)           | [molətjə]   |
| <i>wagentje</i> /vaɣən-tjə/ 'car(t)' (dimin.)         | [vaɣətjə]   |
| <i>regentje</i> /reɣən-tjə/ 'rain' (dimin.)           | [reɣətjə]   |
| <i>openlijk</i> /opən-lək/ 'openly'                   | [opələk]    |
| <i>gezamenlijk</i> /ɣə-zamən-lək/ 'common'            | [ɣəzamələk] |
| <i>eventjes</i> /evən-tjəs/ 'a little while'          | [evətjəs]   |

As pointed out above, /n/ deletes obligatorily in word-initial syllables if the preceding vowel has been turned into a schwa by Vowel Reduction as in *benzine* /bɛnzinə/ 'petrol' [bɛzinə]. However, in this position it is also possible for the /r/ to delete, as in *portier* 'porter' [pəti:r], so this might be a different rule after all.

For many speakers, in particular in the western part of the Netherlands, the deletion of /n/ is obligatory. This may lead to the conclusion that for those speakers the underlying forms of the relevant morphemes end in /ə/ rather than /ən/. Note, however, that this is an incorrect conclusion since there are pairs of related words in which the verb is morphologically related to an /n/-final word, and the /n/ shows up in non-word-final position, for instance in the present plural form and the (phonologically identical) infinitive of the verb:

- |                         |   |
|-------------------------|---|
| (38)                    | <i>Verb (plural present or infinitive)</i>  |
| <i>regen</i> 'rain'     | <i>regenen</i> 'to rain' [reɣənə(n)]        |
| <i>baken</i> 'beacon'   | <i>afbakenen</i> 'to delimit' [ʌvbakənə(n)] |
| <i>zegen</i> 'blessing' | <i>zegenen</i> 'to bless' [zeɣənə(n)]       |
| <i>teken</i> 'sign'     | <i>tekenen</i> 'to draw' [tekənə(n)]        |
| <i>open</i> 'open'      | <i>openen</i> 'to open' [opənə(n)]          |

Therefore, the words in the left column must still have a final /n/ underlyingly.

As pointed out by Koefoed (1979), the rule does not apply to the /n/ that appears at the end of a verbal stem. This is the case for the first-person singular present forms of verbs that have a zero inflectional ending:

- |                         |                                      |
|-------------------------|--------------------------------------|
| (39) <i>Verbal stem</i> | <i>First-person singular present</i> |
| <i>teken</i> 'to draw'  | [tekən], *[tekə]                     |
| <i>oefen</i> 'to train' | [ufən], *[ufə]                       |
| <i>reken</i> 'to count' | [rekən], *[rekə]                     |

This shows again that morphological structure might influence the application

<sup>16</sup> The /n/ also deletes in informal speech before a syllable-final /s/ in frequent words such as *telkens* /telkəns/ 'time and again' [telkəs], *wegens* /veɣəns/ 'because of' [veɣəs], *'s morgens* /s-mɔɣəns/ 'in the morning' [smɔɣəs], *lakens* /lakən-s/ 'sheets' [lakəs], and *ergens* /ɛɣəns/ 'somewhere' [ɛɣəs]. The deletion of the nasal before /s/ may be related to the fact that nasals rarely occur before fricatives (Padgett 1991, 1992). Note that /n/ does not delete before /t/ as in *lopend* 'walking' /lopənd/ [lop-ənt], \*[lopət].

of rules of connected speech: we have to impose a negative condition on the process in that it may not delete /n/s at the end of verbal stems.

The /n/ also deletes at the end of the first prosodic word of compounds and derived words, as expected (cf. Berendsen 1986: 88):

- |                                   |             |
|-----------------------------------|-------------|
| (40) regen-pak (lit.) 'rain suit' | [reɣəpək]   |
| open-baar 'public'                | [opəba:r]   |
| Christen-dom 'Christianity'       | [krɪstədɔm] |

The rule of /n/-deletion can be seen as a rule that deletes the final /n/ of a syllable after a schwa at the end of a morpheme that is not a verbal stem (41).

(41) /n/-deletion

Delete  $\begin{bmatrix} +nas \\ \text{Cor} \end{bmatrix}$  in the context ə —)σ ]<sub>X</sub>

Condition:

X is a morphological boundary but not a verbal stem boundary

The feature [Coronal] is mentioned in order to avoid deletion of the /m/ which also occurs after schwa. This implies that coronal nasals must be specified for Place when /n/-deletion applies.

The requirement that the /n/ is not only syllable-final, but also adjacent to a morphological boundary also correctly excludes deletion of the /n/ in present participles like *volgende* 'following, next' with the morphological structure [ [[volg]<sub>V</sub> end]<sub>V</sub> e]<sub>V</sub>, although the /n/ is syllable-final in such cases. The rule thus shows that the prosodic and morphological structure of a word may have to be referred to simultaneously in a rule (cf. Booij and Lieber 1993).

## 6.9. CONCLUSIONS

A number of specific properties are shared by the rules of connected speech discussed in this chapter. They tend to increase the ease of production, and thus make words less distinguishable. Ease of production can indeed get priority in informal situations in which the speaker can afford to reduce the perceptibility of words. Whether they apply also depends on a number of non-phonological factors: frequency (i.e. the degree of activation of a word in lexical memory), and lexicalization (in the sense of loss of morphological transparency). Moreover, speakers differ in the degree to which they allow for reduction processes to apply. Phonological conditions sometimes appear to be of a gradual nature.

A third property of rules of connected speech is that although a rule may be optional, it may have to apply obligatorily due to the application of another rule. In particular, the behaviour of the rules discussed in this chapter support Dressler's (1974) hypothesis that the use of rules for less formal or less monitored styles of speech implies the use of rules for more formal or more

monitored styles of speech. There also appear to be relations of mutual implication between rules of connected speech.

In the case of fast-speech rules we saw that they may sometimes be seen as cases of retiming rather than as deletion or insertion of segments.

The rules of connected speech that apply across word boundaries, and that are discussed in the next chapter, also exhibit the properties summarized here.

## CONNECTED SPEECH II: SENTENCE PHONOLOGY

### 7.1. INTRODUCTION

In this chapter, we deal with rules that (also) apply across word boundaries. An important theoretical question is that of how to state the domain of such rules: 'Are some of these domains to be defined in terms of syntactic information, as present in the surface structure of sentences, or can they be stated exclusively in terms of prosodic domains?'<sup>1</sup> A related issue is the exact nature of the hierarchy of prosodic domains, the so-called Prosodic Hierarchy.

The domains of rule application for P-rules have been argued to form the following hierarchy (Nespor and Vogel 1986):

(1) *Prosodic Hierarchy*

Syllable ( $\sigma$ )

Foot (F)

Prosodic Word ( $\omega$ )

Clitic Group (C)

Phonological Phrase ( $\phi$ )

Intonational Phrase (IP)

Utterance (U)

The first three categories have to be available at the lexical level, the higher prosodic domains will be constructed on the basis of syntactic structure.

Evidence for the foot was given above in relation to glottal-stop insertion in hiatus position (Section 4.2.3) and the stress-related phenomenon of vowel reduction (Section 6.4)<sup>2</sup>

Nespor and Vogel (1986) also proposed the domain of the Clitic Group. However, it is doubtful whether we really need this domain (cf. Booij 1988c, Zec 1988, Malikouti-Drachman and Drachman 1992). As far as Dutch is concerned, it is argued in Chapter 8 that clitics are incorporated into the preceding, or Chomsky-adjoined to the following prosodic word, without forming a prosodic category of their own.

The next prosodic category is the Phonological Phrase. As for the construction of phonological phrases, it is usually assumed that each word of a lexical

<sup>1</sup> Cf. Booij (1992a) for a survey of this discussion.

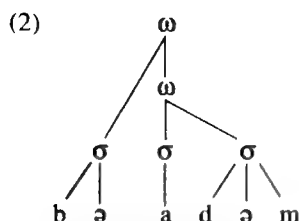
<sup>2</sup> Arguments for the foot as part of the Prosodic Hierarchy are given in Poser (1989, 1990), McCarthy and Prince (1990), and Itô and Mester (1992).

category forms a phonological phrase with either the preceding or the following function words (determiners, prepositions, conjunctions, auxiliaries). According to Selkirk (1986) this is a parameter: English joins function words with the following lexical category into a phonological phrase; in Japanese it is just the inverse: function words form a phonological phrase with the preceding lexical category. For Dutch I will assume that, when possible, function words form  $\phi$ s with the following prosodic word, except when the function word is encliticized to the preceding prosodic word (cf. Chapter 8). Function words at the end of a sentence necessarily join the preceding  $\phi$ .

The Intonational Phrase is the domain of assignment of intonation contours on the basis of sentence accents, and simultaneously the domain of application of some segmental phonological rules. In Nespor and Vogel (1986) it is assumed that the boundaries of domains for the assignment of sentence accents coincide with pauses. However, as pointed out by Ladd (1986) we may have more than one sentence accent in a clause, and thus the clause would have to split up in, for example, two IPs, although there is no pause in between these two IPs.<sup>3</sup> According to Gussenhoven (1992b) there is no single prosodic category that can be identified with the domain of intonational contour assignment (cf. also Gussenhoven and Rietveld 1992). For the time being, I will assume the definition of IP as given by Nespor and Vogel (roughly: a clause, a parenthetical expression, and each of the two parts of a clause interrupted by a parenthetical expression), and I will only use the IP as the prosodic constituent surrounded by potential pauses that functions as the domain of application for certain segmental P-rules.

In Prosodic Phonology, it is also assumed that each domain can exhaustively be divided into one or more domains of the next lower level, the so-called Strict Layer Hypothesis (Selkirk 1984b: 26; 1986: 384, Nespor and Vogel 1986). For instance, a syllable node cannot be directly dominated by a prosodic word node. This hypothesis may have to be weakened in two directions. First, Itô and Mester (1992) argued that we have to allow for skipping of one level: in Japanese a syllable node may be dominated directly by a prosodic word node, without an intervening foot node. Second, we may ask whether recursivity should be allowed for. For instance, what is the prosodic category of compounds, which consist of at least two prosodic words: is it a  $\omega$  or a  $\phi$ ? The first option implies that we have to allow for recursivity of prosodic categories. This issue also plays a role in the prosodic analysis of prefixed words: prefixes with schwa as their only vowel cannot form prosodic words of their own. Hence, the prosodic structure (2) seems to be the most appropriate one (skipping the foot level) for a prefixed verb like *beadem* 'to breathe':

<sup>3</sup> Beckman and Pierrehumbert (1986) therefore conclude that we need a additional prosodic constituent in between  $\phi$  and IP, the *Intermediate Phrase*, as the domain of intonational contour assignment.



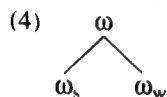
This structure correctly predicts that a syllable boundary coincides with the prefix boundary. Formally, it is a case of Chomsky-adjunction of a syllable to a prosodic word, thus creating a new prosodic word node. Thus, it follows that Prevocalic Schwa Deletion does not apply, except in very fast or informal speech where such boundaries are ignored. This rule requires that the schwa to be deleted and the next vowel are dominated by the same prosodic word node. This is not the case in structure (2) given the following definition of dominance (Chomsky 1986: 7):

(3) Dominance

$\alpha$  is dominated by  $\beta$  only if it is dominated by every segment of  $\beta$

In the example *headem* the prefixal schwa ( $\alpha$ ) is not dominated by the prosodic word node ( $\beta$ ) because it is not dominated by the lowest  $\omega$ -node. Hence, the rule does not apply, as required.

Similarly, compounds may be assumed to form prosodic structures of the following type in which a prosodic word is Chomsky-adjointed to a preceding prosodic word:



Again, rules that have the prosodic word as their domain will not apply to such compound structures given the definition of dominance in (3).

In sum, it seems necessary to weaken the Strict Layer Hypothesis in so far as we have to allow for adjunction of prosodic categories to other prosodic categories.

In the next sections of this chapter, the role of the Phonological Phrase and the Intonational Phrase are illustrated. It is shown that other levels of representation such as the argument structure of the sentence may also play a role in sentence phonology.

## 7.2. PHONOLOGY ABOVE THE WORD LEVEL

In Chapter 4 it is repeatedly pointed out that many of the P-rules discussed there that apply obligatorily in the domain of the prosodic word—and often also in compounds—apply optionally in larger domains such as (compounds



and) phrases. The same point will be made with respect to /t/-deletion (Section 7.2.6): this rule exhibits the properties of variable rules in that the rule applies above the level of the prosodic word, but with a larger degree of optionality.

In general, we expect rules of connected speech to apply more frequently in smaller domains than in larger domains because words are tied together more closely in smaller domains than in larger domains.

For Dutch, the issue of the prosodic domains of rules above the level of the prosodic word is an underresearched area. It is sufficient for present purposes to assume that the probability of application of P-rules above the word level decreases as the relevant prosodic domain of application becomes larger. In other words, I do not assign a particular prosodic domain to P-rules, but generally they are restricted to being applied within intonational phrases. This implies that they are postlexical rules, and that they can also apply in smaller domains than the IP.

### 7.2.1. Voice Assimilation

The rules of voice assimilation presented in Chapter 4 are illustrated there mainly by means of compounds, i.e. assimilation across  $\omega$ -boundaries. Voice assimilation also applies in larger domains, across  $\phi$ -boundaries (Loots 1983, Menert 1988). The following examples illustrate this:

- (5) ( (dat ik) $\phi$  (aan de rand) $\phi$  (van het bos) $\phi$  (bouw) $\phi$  )<sub>IP</sub>  
           that I     at the edge     of the wood     build

rand van /rand van/ 'edge of' [rantfan] (Progressive Assimilation)

bos bouw /bɔs bɔu/ 'wood build' [bɔzbɔu] (Regressive Assimilation)

- (6) ( (op die manier) $\phi$  (zal Piet) $\phi$  (zakken) $\phi$  )<sub>IP</sub>  
           in that way             will Peter fail'

op die /ɔp di/ 'in that' [ɔbdi] (Regressive Assimilation)

Piet zakken /pit zukən/ 'Peter fail' [pitsukən] (Progressive Assimilation)

Note that in the sequences *bos bouw* and *Piet zakken* the words are separated by a  $\phi$ -boundary, since they are words of lexical categories which head a phonological phrase of their own.

Loots's (1983) investigation of regressive assimilation clearly indicates that the rule has the IP as its domain, and also that the rule applies more frequently if the consonants involved belong to the same phonological phrase: there was a clear difference in frequency of application of regressive assimilation within compounds from that within sentences. Since the prosodic words of a compound of course belong to the same phonological phrase, we can state that voice assimilation applies more frequently in  $\phi$ s than in IPs.

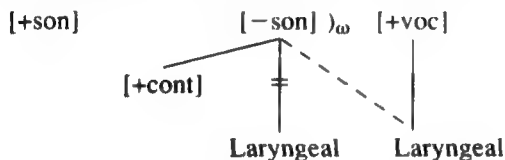
A rule of voice assimilation which only applies across a prosodic word boundary is that of Fricative Voicing that voices prosodic word-final fricatives preceded by a sonorant, and followed by a vocoid (cf. Zwaardemaker and

Eijkman 1928: 226, Gussenhoven and Broeders 1976: 140). The following examples illustrate this type of voicing:

- (7) pas op 'be careful' [pazɔp]  
 huisarts 'GP' [hœyɜrts]  
 was je 'were you' [vʌʒjə]  
 hoefijzer 'horse shoe' [huvcizər]  
 twaalf uur 'twelve o'clock' [tvalvy:r]

Note that voicing of fricatives does not occur within prosodic words (Gussenhoven 1985). Thus we may get systematic phonetic differences between *kiesje* [kɪʃjə] 'molar' (dimin.) and *kies je* [kɪʒjə] '(lit.) choose you', and between *wasje* [vʌʃjə] 'wash' (dimin. noun) and *was je* [vʌʒjə] '(lit.) were you', because the diminutive suffix *-je* is a cohering suffix, and thus forms one prosodic word with its base. The rule can be stated as (8).

(8) Fricative Voice Assimilation



The frequency of application of rules of sentence phonology such as voice assimilation is of course also determined by the performance factors discussed in Chapter 6, particularly degree of monitoring and speech rate (Menert 1988). There are also individual differences (Slis 1985).

### 7.2.2. Nasal Assimilation

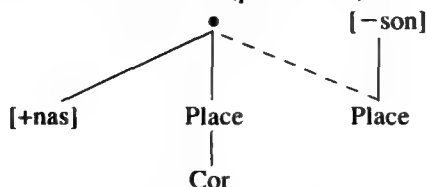
Examples of the application of Nasal Assimilation across word boundaries are given in Chapter 4. The examples there are all prepositional phrases, which form one phonological phrase. There is no evidence that Nasal Assimilation does not apply in the larger domain IP. For instance, in the following sentences, Nasal Assimilation seems to be possible for the final nasals of *baan* 'job' /ban/ and *boon* 'bean' /bon/:

- (9) Wie de baa[n] krijgt . . .  
 'Who the job gets . . .'

Wie de boo[m] pakt . . .  
 'Who the bean takes . . .'

It should be remembered, however, that such observations are based on intuitions only, and require experimental underpinnings. Moreover, as pointed out by Nolan (1992), assimilations may be only partial. In cases of partial Nasal Assimilation, the nasal would be partially Coronal, partially Dorsal or Labial, which may be represented as follows (cf. Hayes 1992):

## (10) Nasal Assimilation (postlexical)



In other words, whereas nasal assimilation in word phonology spreads the Place feature of the following consonant to the preceding underspecified nasal consonant, nasal assimilation at the postlexical level only affects coronals. This, by itself, could be represented by leaving coronal nasals unspecified until after Nasal Assimilation has applied postlexically, provided that the nasal consonant assimilates completely. However, if the first stage of the nasal consonant can also be coronal, the coronal nasal must be specified as such before spreading of the Place feature of the following consonant takes place. The actual stretch of alveolar articulation may vary with speech rate and degree of monitoring. Moreover, as argued in Section 4.3.2, certain lexical rules already require the proper identification of the coronal nasal which therefore cannot be left unspecified until the postlexical level. Consequently, we cannot identify the lexical and the postlexical processes of nasal assimilation.

In the case of word-final /n/ preceded by a schwa the /n/ will delete through the rule of /n/-deletion instead of being assimilated:

- (11) *de kleden* [kledə] *pakken* '(lit.) the carpets take', i.e., 'to take the carpets'  
*de kleden* [kledə] *kloppen* '(lit.) the carpets beat', i.e., 'to beat the carpets'

In the case of nasals before fricatives another phenomenon plays a role. As observed by Trommelen (1984: 265)<sup>4</sup> an alveolar nasal may be deleted in fast speech before a following fricative. According to Gussenhoven and Broeders (1976) nasal deletion is even more general, applying before non-plosives. The preceding vowel will then be nasalized and somewhat lengthened:

- (12) *on-fatsoenlijk* 'indecent' /ɔn-fatsunlək/ [ɔ̃fatsunlək]  
*on-zeker* 'uncertain' /ɔn-zekər/ [ɔ̃zekər]  
*on-gewoon* 'abnormal' /ɔn-ɣəʋon/ [ɔ̃ɣəʋon]  
*wan-gedrag* 'misbehaviour' /ʋan-ɣədrax/ [ʋāɣədrax]  
*on-weer* 'thunderstorm' /ɔn-ver/ [ɔ̃ve:r]  
*on-rustig* 'unquiet' /ɔn-rystəɣ/ [ɔ̃rystəx]
- de ton grijpen* '(lit.) 'the ton grab', '(lit.) to grab the ton' [tɔ̃ɣreipən]  
*de ton pakken* '(lit.) the ton take', i.e., 'to take the ton' [tɔ̃mpəkən]

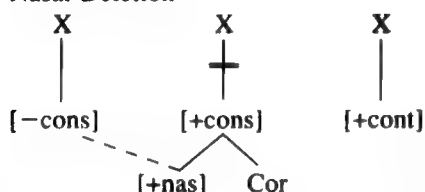
This process does not apply to non-coronal nasals. It may be phonetically 'explained' in that the sequence nasal + continuant requires two different

<sup>4</sup> Trommelen mentions Zwaardemaker and Eijkman (1928: 230) and Eijkman (1955: 107) as her sources.

gestures with respect to the degree of stricture of the vocal tract: first, a stop and then a continuant. In the case of a nasal followed by a plosive obstruent the two consonants can be realized with the same gesture. This may also explain why nasals do not co-occur with fricatives in the same coda in Dutch, and that this sequence, even when it is a heterosyllabic cluster, is rather rare within morphemes, compared to clusters of nasals + plosives, an example being *kamfer* 'camphor'.<sup>5</sup> The restriction of this process to the alveolar nasal is the same as that found for other processes of assimilation and reduction in connected speech: it is always the alveolar nasal that is subject to such processes.

The rule for this kind of nasal deletion with compensatory lengthening may be stated in (13).<sup>6</sup>

(13) Nasal Deletion



The rule is a case of delinking-cum-spreading: the features of the nasal consonant are all delinked from the X-slot, and the feature [+nasal] is relinked to the preceding vowel, thus creating a nasalized vowel. I assume that the feature [-consonant] will subsequently spread to the vacated X-position, which accounts for the lengthening effect on the preceding vowel. The way in which the rule is formulated expresses the insight that such rules are basically a matter of retiming: the melodic segments are not deleted, but the features are distributed in a different way. Moreover, Eijkman (1955) states that the vowel is only optionally lengthened in addition to being nasalized, which is understandable in view of the fact that the available articulation time is reduced anyway in this kind of speech.

The rule may also apply word-internally, in particular when a velar nasal precedes a velar fricative. For instance, words like *congres* 'congress' /kɔŋɣrɛs/ and *fungeren* 'to function' /fʏŋɣɛrən/ can be pronounced with a nasal vowel and without the nasal consonant being realized. A special case is the pronunciation of the word *koningin* 'queen' /konɪŋ+ɪn/ as [konəɣɪn] (in addition to the standard pronunciation [konɪŋɪn]) because the velar fricative [ɣ] that shows up here is synchronically not present in the underlying form of the base word *koning* 'king' /konɪŋ/. It is also remarkable that the combination velar nasal + stop has survived in a number of native words such as *koninklijk*

<sup>5</sup> See Padgett (1991, 1992) for cross-linguistic evidence concerning this difference between fricative and plosives with respect to combinability with other consonants.

<sup>6</sup> This formulation implies that /n/ is not deleted before /l/ which is [-cont], a correct prediction as far as I know.

'royal' [konɪŋklək], whereas the velar fricative systematically disappeared after velar nasals, again suggesting that such clusters have a marked character.

In western varieties of standard Dutch one may also find /n/-deletion before /s/ within lexical morphemes, with concomitant lengthening and nasalization of the vowel:

- |                 |        |
|-----------------|--------|
| (14) Hans 'id.' | [hā:s] |
| gans 'goose'    | [ɣā:s] |
| kans 'chance'   | [kā:s] |
| ons 'ounce'     | [ō:s]  |

This phenomenon can be accounted for by dropping the condition on Nasal Deletion that the continuant stand at the beginning of a prosodic word. However, as pointed out, the process does not belong to standard Dutch.

### 7.2.3. *Hiatus rules*

In Chapter 4, we discussed two hiatus rules, Homorganic Glide Insertion (HGI) and Prevocalic Schwa Deletion. HGI also applies in compounds, in other φs, and in IPs (cf. Berendsen and Den Os 1987):

- (15) φ  
 zee[j]arend 'sea eagle'  
 toe[v]eigenen 'to appropriate'  
 sherry[j]achtig 'sherry-like'  
 twee-en-twintig 'twenty-two' [twejəntwintəx]  
 die [j] avond 'that evening'

#### IP

- ( (Marie)<sub>φ</sub> [j] (eet niet)<sub>φ</sub> )<sub>IP</sub>  
 'Mary does not eat'  
 (Henk)<sub>φ</sub> (haalde)<sub>φ</sub> (de vlo)<sub>φ</sub> [v] (uit het eten)<sub>φ</sub> )<sub>IP</sub>  
 'Henk removed the flea from the food'

Schwa deletion appears to be more restricted at the postlexical level. In particular, it does not apply to schwa-final prefixes, except in some lexicalized forms such as *gereformeerd* 'reformed' [ɣrɛfɔrmɛ:rt] and *geloven* 'to believe' [ɣlɔvən]:

- |                           |           |
|---------------------------|-----------|
| (16) b[ə]-amen 'to agree' | *[bāmən]  |
| b[ə]-ogen 'to aim'        | *[bɔɣən]  |
| g[ə]-opend 'open'         | *[ɣɔpənt] |

On the other hand, it may apply within compounds and in noun phrases beginning with the determiner *de*, that is, within φs:

- |  |                 |
|--|-----------------|
| (17) mod[ə]-adviseur 'fashion adviser' | [modʊtʃisø:r]   |
| d[ə] avond 'the evening'               | [dʌvənt]        |
| rod[ə] aardbeien 'red strawberries'    | [roda:rtbeijən] |

Application of this process is characteristic of casual speech. This is also clear from the fact that the preposition *te* /tə/ is not subject to reduction, unlike the phonologically similar article *de*, presumably because this preposition is only used in very formal styles of speech. The absence of reduction in prefixes can be related to the observation made in Section 6.4 that morphological boundaries impede reduction processes.

If the schwa deletes, the preceding consonant becomes the onset of the next syllable. Thus, the effect of both HGI and Prevocalic Schwa Deletion is that the number of onsetless syllables reduces. After a pause, that is, when there is no resyllabification, a glottal stop is always inserted before the vowel-initial word after the pause (Jongenburger and Van Heuven 1991).

#### 7.2.4. Degemination

Degemination is one of the rules that apply obligatorily within prosodic words. When two identical consonants come together within a complex word or a phrase, one of them may be deleted (or they may be said to become one consonant; phonetically it may be the case that the length of a geminate consonant is still somewhat larger than that of its single counterpart):

- |  |           |
|--|-----------|
| (18) ver-rassen /vər-rasən/ 'to surprise'    | [vɛrasən] |
| pak-kans /pək-kans/ 'chance of being caught' | [pakans]  |
| ik koop /ɪk kop/ 'I buy'                     | [ɪkop]    |
| aan-name /an-namə/ 'assumption'              | [anamə]   |
| in Namen /ɪn namən/ 'in Namen'               | [ɪnamən]  |
| Jan nam /jan nam/ 'John took'                | [janam]   |

The rule is the same as that given in Section 4.2.4. The only difference is that it is optional as a postlexical rule, and its domain is the IP, as shown by the last example of (18).

#### 7.2.5. Palatalization

Palatalization affects alveolar consonants before a /j/. Palatalization is clearly observable before the personal pronoun *je* when it joins the preceding prosodic word. In other words, the parts *anje* /anjə/ of *Spanje* /spanjə/ 'Spain' and *kan je* /kan jə/ 'can you?' are phonetically identical when *je* is encliticized.

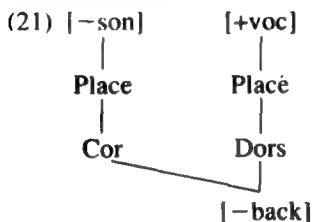
- |                         |                   |
|-------------------------|-------------------|
| (19) had je? 'had you?' | [haɪjə] or [haɪə] |
| was je? 'were you?'     | [ʋɑɹjə] or [ʋɑɹə] |
| kan je? 'can you?'      | [kaɳjə] or [kaɳə] |
| ben je? 'are you?'      | [bɛɳjə] or [bɛɳə] |

In larger prosodic domains, palatalization is certainly possible in casual and fast speech, as in:

- (20) ( (Ik ken)<sub>φ</sub> (je moeder)<sub>φ</sub> )<sub>IP</sub> 'I know your mother' [ɪkɛɳjəmudər]

In the case of /n/-final auxiliaries such as *kan* and *ben* it is also possible to delete the /n/ before /j/: *kan je* 'can you' [kəjə], *ben je* 'are you' [bɛjə].

The question whether the /j/ after palatalized consonants is still there as a separate segment is clearly a matter of speech style and speech rate, in other words, a question of timing of the articulatory gestures with respect to the X-tier. For instance, the relevant part /sj/ of the representation of *was je* after Palatalization will be as in (21).



Since the feature [-back] of the /j/ is now linked to the preceding consonant, the original X dominating that feature can be deleted in fast speech, while leaving the information concerning the place of constriction intact.

#### 7.2.6. /t/-deletion

The rule of /t/-deletion is typically one of the processes that occur in fast speech, but to a lesser extent also in careful speech.

If a /t/ in a coda is preceded by an obstruent, and followed by another consonant, the /t/ may delete. This is illustrated here first for diminutive nouns in which deletion is obligatory:

- (22)
- |                       |          |
|-----------------------|----------|
| klacht-je 'complaint' | [kləxjə] |
| abt-je 'abbot'        | [əpjə]   |
| pact-je 'pact'        | [pəkjə]  |
| markt-je 'market'     | [mərkjə] |
| kaft-je 'cover'       | [kəfjə]  |
| kast-je 'cupboard'    | [kəfjə]  |

The /t/ does not delete, however, when the preceding consonant is a sonorant consonant:

- (23)
- |                 |                    |
|-----------------|--------------------|
| tand-je 'tooth' | [təntjə], *[tənjə] |
| hemd-je 'shirt' | [hɛmtjə], *[hɛmjə] |
| hart-je 'heart' | [hərtjə], *[hərjə] |
| kilt-je 'kilt'  | [kɪltjə], *[kɪljə] |

The rule of /t/-deletion also accounts for the obligatory deletion of the /t/ before the suffixes -s and -st:

- (24)
- |                           |        |
|---------------------------|--------|
| echt-st 'most real'       | [ɛxst] |
| echt-s '(something) real' | [ɛxs]  |

licht-st 'lightest'	[lɪxst]
licht-s '(something) light'	[lɪxs]

Like diminutive nouns, these forms consist of one prosodic word.

In compounds the deletion of /t/ is optional, although for many speakers it will be obligatory in frequent words such as *postkantoor* 'post office' (the deletable /t/ is in *italic*):

- (25) vracht-wagen 'truck'  
 markt-plein 'market square'  
 herfst-kleuren 'autumn colours'  
 post-bank '(lit.) Post Office Bank'  
 pact-sluiting 'pact agreement'  
 zicht-baar 'visible'  
 abt-loos 'abbotless'  
 on-acht-zaam 'negligent'

If the preceding consonant is a sonorant, /t/-deletion is also possible, but then the following consonant must be an obstruent; moreover, native speakers may differ as to whether /t/-deletion is possible in all cases, and lexicalization and frequency play a role:

- (26) Compounds
- |                          |            |
|--------------------------|------------|
| bandbreedte 'band width' | [bʌmbretə] |
| tandsteen 'tartar'       | [tʌnstɛn]  |
| tandpasta 'toothpaste'   | [tʌmpʌstə] |
- Prefixed verbs
- |                          |             |
|--------------------------|-------------|
| ont-ploffen 'to explode' | [ɔmploʊfən] |
| ont-staan 'to arise'     | [ɔnstʌn]    |

When the obstruent following the sonorant + /t/ cluster is /k/, deletion does not apply, as in *bontkraag* 'fur collar'. When /t/ is preceded by a sonorant, and also followed by a sonorant, deletion is impossible:

- (27) kant-lijn 'margin'      \*[kʌnlɛɪn]  
 ont-lopen 'to avoid'      \*[ɔnloʊpən]

/t/-deletion is typically a variable rule in the Labovian sense (Labov 1972) in that certain factors further the actual application of the rule. In the case of deletion of /t/ it was also found that, for English, the less sonorous the following segment is, the easier deletion can apply (Guy 1980, Neu 1980). The fact that the domain of application also plays a role has already been mentioned: within prosodic words deletion is obligatory, which accounts for diminutives and for superlative forms. In prefixed words and compounds, /t/ is separated from the following consonant by a prosodic word boundary, hence deletion can more easily be suppressed there. Across phrasal boundaries, /t/-deletion is possible if both the preceding and the following consonants are obstruents, less probable after or before a nasal consonant, and even less probable before liquids and glides:



(28) Wint Piet? 'Does Peter win?'	[ʋɪnpit]
Komt Piet? 'Does Peter come?'	[kɔmpit]
Zakt Piet? 'Does Peter fail?'	[zakpit]
Zakt Marie? 'Does Mary fail?'	[zakmari]
Zakt Ria? 'Does Ria fail?'	*[zakrija]
Zakt Jan? 'Does John fail?'	*[zakjun]

Thus, we formulate /t/-deletion as (29).

(29) /t/-deletion

Delete [-cont, Coronal] in: ([+cons] —)<sub>CODA</sub> [+cons]

Domain: IP

Condition: at least one of the [+cons] segments must be [-son]

The condition rules out deletion of /t/ in words like *kantlijn* 'margin' and phrases like *Komt Jan?* 'Does John come?'.<sup>7</sup> The rule does not distinguish between /t/ and /d/, but this is not necessary since /d/ does not occur in the relevant context, the coda position. The requirement of a consonant following the /t/ implies that, unlike in English, the /t/ does not delete at the end of an IP.<sup>8</sup>

As pointed out in Section 6.6, Browman and Goldstein (1990) conceive of fast speech rules as retiming of the articulatory gestures, with masking effects, rather than interpreting such phenomena in terms of the actual deletion of segments. They adduce some evidence that in the case of English /t/-deletion, the /t/ is indeed masked in perception but not completely absent in terms of production. The concept of retiming may also explain why deletion applies more readily in smaller domains: since a prosodic word is a smaller domain than, for instance, a compound or a phrase in terms of the time dimension, reduction of time will have comparatively stronger effects in a prosodic word than in a compound or phrase. Nevertheless, in words with obligatory /t/-deletion, the /t/ is completely absent, since we do not perceive any phonetic difference between *kastje* 'cupboard' (dimin.) and *kasje* 'greenhouse' (dimin.) both pronounced as [kʌfjə].

### 7.3. SENTENCE ACCENT

As pointed out in Section 5.1, the main stressed syllable of a word is a potential locus of sentence accent. The stressed syllable is the 'anchor point'

<sup>7</sup> The 2 sg. pres. form of Dutch verbs ends in /t/, but is /t/-less if the subject pronoun *je* follows the verb: *je komt* 'you come', but *Kom je?* 'Do you come?'. The absence of /t/ in the case of the inverted word order is clearly not a phonological phenomenon, but a case of syntactically conditioned allomorphy, given the constraints on /t/-deletion discussed here.

<sup>8</sup> However, word-final deletion of /t/ does occur in some non-standard dialects such as that of Utrecht and Leiden (cf. De Vries *et al.* 1974). In standard Dutch we find deletion of /t/ in word-final position after a vowel in function words like *niet* /nit/ 'not' and *wat* /vat/ 'what' which can be pronounced as [ni] and [vʌ] respectively in informal language use.

of the pitch movements that give prominence to certain constituents of a sentence.

The location of sentence accents is determined by semantic and pragmatic factors (Selkirk 1984*b*, Gussenhoven 1984). For instance, the following sentence can have two locations for its sentence accent, depending on which background knowledge is assumed:

- (30) *a.* \*  
 (Waar is Jan?) Jan is in de kamer.  
 'Where is John? John is in the lounge.'
- b.* \*  
 (Wie is in de kamer?) Jan is in de kamer.  
 'Who is in the lounge? John is in the lounge.'

In (30*a*) the prepositional phrase *in de kamer* is a constituent that is meant as new information, i.e. it carries focus. The non-focused part is what the speaker takes as his starting point. In (30*b*) the constituent *Jan* is the constituent with focus, and thus it gets a sentence accent. In other words, the basic rule is that each focused constituent bears a sentence accent. It is also possible to use 'narrow focus' accent with a contrastive function as in:

- (31) \* \*  
 Jan is in de kamer, niet in de keuken.  
 'John is in the lounge, not in the kitchen.'

Note that syntactic structure plays a role in that in the prepositional phrase *in de kamer* it is the noun, that is, a member of one of the major lexical categories, that bears the sentence accent, not one of the function words *in* or *de*. Sentence accent on a function word is also possible, if the sentence accent has a contrastive function:

- (32) \* \*  
 Het boek ligt niet in, maar onder de kast.  
 'The book is not in, but under, the bookcase'

Here, only the prepositions are [+focus] elements, whereas *de kast* functions as background knowledge. This example also serves to illustrate that function words must be provided with a main stress in word phonology for determining the potential locus of sentence accent, for example, on the first syllable of the preposition *onder*.

The relation between focus and sentence accent in Dutch has been investigated by Gussenhoven (1984, 1992*a*). In particular, he showed that a predicate may not receive a sentence accent even if it is [+focus]. Gussenhoven distinguishes between three types of constituents in a clause: each clause contains a predicate (P), zero or more arguments (A), and any number of modifiers (M), constituents with an adverbial function. Arguments are noun phrases or prepositional phrases for which a predicate is subcategorized in its lexical entry. Gussenhoven proposed the following rule for sentence accents:

### (33) Sentence Accent Assignment Rule (SAAR)

If focused, every predicate, argument, and modifier must be accented, with the exception of a predicate that, discounting unfocused constituents, is adjacent to an argument. (Gussenhoven 1992a: 84)

This rule can be formulated as an algorithm. First, we determine which parts of a clause are [+focus] (indicated by underlining), then we determine the domains of sentence accent assignment, and finally we accent the relevant constituents (Gussenhoven 1984: 69):

### (34) SAAR Algorithm

- a.* Domain assignment:  
(ordered)
- |          |     |          |   |     |     |    |
|----------|-----|----------|---|-----|-----|----|
| <u>P</u> | (X) | <u>A</u> | → | [P  | (X) | A] |
| <u>A</u> | (X) | <u>P</u> | → | [A  | (X) | P] |
| <u>Y</u> |     |          | → | [Y] |     |    |
- b.* Accent assignment  
In [AP/PA] accent A
- |     |   |     |
|-----|---|-----|
| [ ] | → | [*] |
|-----|---|-----|

The working of SAAR is illustrated by the following examples:<sup>9</sup>

- (35) a. (Has anyone resigned?)

$$AP \rightarrow [A]P$$

\*  
De voorzitter is afgetreden.  
'The chairman has resigned.'

- b. (What's new?)**

$$AP \rightarrow [AP]$$

\*  
De voorzitter is afgetreden.

- c.  $\underline{\text{AMP}} \rightarrow [\text{A}][\text{M}][\text{P}]$       De voorzitter is inderhaast afgetreden.  
'The chairman has hurriedly resigned.'

- d. (Why can't the chairman do that?)**

$$AP \rightarrow A [P]$$

\*

De voorzitter is afgetreden.

The examples (35a) and (35b) have the same sentence accent, although they differ with respect to focus. This reflects the ambiguity of this sentence with respect to the size of the focused constituent, either part of the sentence, or the whole sentence. In other words, if possible, predicate and argument form one domain of sentence accent assignment, and it is the argument that then receives the sentence accent. In (35c) the focused predicate and the focused argument are separated by a focused modifier, and therefore they form separate domains of accent assignment, resulting in a sentence with three sentence accents.

<sup>9</sup> Taken from Gussenhoven (1984: 70).

The ordering of the creation of [AP] domains before [PA] domains accounts for the fact that in a sentence like

- (36)           \*           \*  
           Jan slaat zijn vrouw.  
           'John beats his wife.'

there is a prosodic break after *Jan*, i.e., it is *slaat zijn vrouw* that forms a domain rather than *Jan slaat*.

As pointed out by Gussenhoven (1984: 27), the SAAR also explains the difference in accentuation between the following two sentences discussed by Schmerling (1976):

- (37)                               \*  
           (Have you heard?) Johnson died.

- (38)                               \*  
           (Have you heard?) Truman died.

In the second sentence, it is presupposed that the hearer already knows that Truman is very ill. Hence, it is only the predicate that is [+focus], and therefore the sentence accent is located on the verb. This observation also holds for equivalent Dutch sentences.

The sentence accent in the constituent *is afgetreden* in sentence (35d) is located on *af*. The location on *afgetreden* is to be expected since *is* is a function word. *Afgetreden* is the participle of the separable complex verb *af treden* 'to resign'. These verbs are complex predicates in that they form a semantic unit, but yet they are phrases from the syntactic point of view (Booij 1990a): the two parts can be separated in main clauses, as in:

- (39) Jan belt zijn moeder op.  
       'John phones his mother.'

The sentence accent assignment in the following examples shows that if the two parts of the complex predicate are separated, they still form one domain of sentence accent assignment (the underlined part is [+focus]):

- (40)   (What's Jan doing?)  
                               \*  
       a. Jan belt zijn moeder op.  
           'Jan phones his mother.'

- \*  
       b. Jan belt op.  
           'John makes a phone call.'

The location of the sentence accent in (40b) shows that when a complex predicate is accented it is the non-verbal part that receives the accent.

There are a number of complications in the assignment of sentence accent. First, a pronoun with [+focus] forms a domain of its own, not with the

following predicate, as is illustrated by the following examples (Gussenhoven 1984: 73):

(41) (What's the matter?)

a. De gevangenen zijn ontsnapt!

'The prisoners have escaped.'

\*

\*

b. Iedereen is ontsnapt!

'Everyone has escaped.'

In (41*b*) the argument *iedereen* does not form a domain together with the following predicate. Therefore, the predicate forms a domain of its own, and receives its own sentence accent: sentence (41*b*) without sentence accent on the predicate is ill-formed.

Second, SAAR is meant as a generalization for so called eventive sentences. Eventive sentences present the proposition 'as a historical development of some sort, while a non-eventive sentence could serve as a description of the status-quo ('definitional sentence'), or convey information which is potentially relevant to the listener ('contingency sentence')' (Gussenhoven 1992a: 103). The distinction is nicely illustrated by the two interpretations of the sentence *De directie geeft dieven aan* 'The management turns thieves in'. It may be a general statement on a sign in a shop, as in (42*a*), or the description of an event, as in (42*b*). In the first case, the sentence is non-eventive, and therefore each focused constituent receives its own sentence accent. That is, skipping the predicate in the assignment of sentence accent as expressed by the SAAR is characteristic of eventive sentences (*geeft aan* is a discontinuous complex predicate here):

(42) a.               \*               \*               \*

De directie geeft dieven aan.

b.               \*               \*

De directie geeft dieven aan.

In addition to SAAR, sentence accent is also assigned by Topicalization. A constituent that is preposed by Topicalization to the first position in the sentence receives a sentence accent even if it is not [+focus]:

(43) (What happened to Yvonne?)

\*

\*

Yvonne heeft hij gearresteerd.

Yvonne has he arrested.

'He arrested Yvonne.'

In this example, *Yvonne* is background knowledge, and hence it is [-focus]. Although the argument *Yvonne* and the predicate are only separated by a [-focus] constituent, they cannot form one domain: the Topic constituent

forms a sentence accent domain of its own, and hence *gearresteerd* also receives sentence accent.

This effect of Topicalization also explains why the weak forms of pronouns are excluded from being topicalized: they cannot bear stress, and hence they are also unable to receive sentence accent. In other words, it is not necessary to constrain syntactic rules of topicalization in such a way that they do not affect weak pronouns: this follows from their prosodic properties.<sup>10</sup>

Attributively used adjectives do not count as constituents for the SAAR. Yet, they may function as focus constituents independently from the following noun, and then they are accented. When the adjective is preceded by an adverb, however, the sentence accent is on the adverb:

(44) (What did you see?)

■

*Ik zag een leuk meisje.*

'I saw a nice girl.'

(45) (What do you think of her?)

■

*Ik vind haar een leuk meisje.*

'I consider her a nice girl.'

(46) (What did you see?)

■

*Ik zag een erg leuk meisje.*

'I saw a very nice girl.'

In (45) the use of *haar* 'her' already presupposes the existence of a specific female being in the background knowledge of the hearer, and hence it is only *leuk* that is [+focus]. Adjectives also form focus domains when used contrastively, as in

(47) \*

*Mijn oudste oom is overleden.*

'My eldest uncle has died.'

This survey of factors determining the location of sentence accents is by no means exhaustive, but presents the basic generalizations; cf. Gussenhoven (1984, 1992a) for more detailed studies.

The next issue to be discussed is the actual realization of sentence accents as pitch movements. It has been found for English that a sentence accent can be

<sup>10</sup> In the case of weak pronouns, there is an alternative strong form that can be used in topic position, with the phonological properties required for being a prosodic word. The same applies to the determiner *het*: if it is to carry sentence accent (e.g. in order to express the uniqueness of referent of the noun phrase), we cannot use the form [ət], only the form [het], which forms a prosodic word of its own. The only exception is *de* /də/. It has no strong form, and hence we have to use it even if it has to bear sentence accent because there is no alternative.

realized as a fall, a rise, or a fall-rise. These patterns can be interpreted as tonal morphemes consisting of contour tones (Gussenhoven 1984, 1988):

- (48) H\*L        falling tone  
       L\*H        rising tone  
       H\*LH      falling-rising tone

The asterisk following a tone indicates that this tone is to be linked to the syllable with the sentence accent. The following tone or tones are spread across the rest of the association domain. Furthermore, there is a copy of the last tone of the contour that functions as a boundary tone (indicated by H% or L%) at the end of an intonational phrase. The resulting tone patterns are illustrated here for sentence (49).

- (49) Leeuwarden wil meer mannen.  
       'Leeuwarden needs more men.'

with both one (Fig. 7.1) and two (Fig. 7.2) sentence accents, and with either H\*L or L\*H as the first sentence accent (from Van den Berg *et al.* 1992):

The part of a phonological phrase before the first sentence accent may be called the onset, and usually has low pitch. The prosodic boundary is also indicated. As Van den Berg, Gussenhoven, and Rietveld (1992) point out,

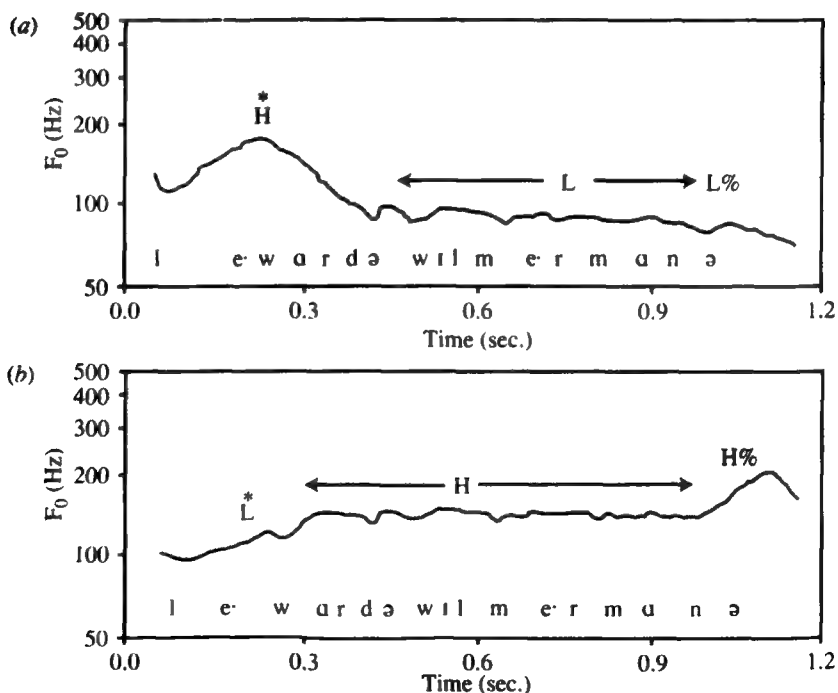


FIG. 7.1. Contours (H\*L L%)<sub>AD</sub> and (L\*H H%)<sub>AD</sub> on the sentence *Leeu\*warden wil meer mannen*

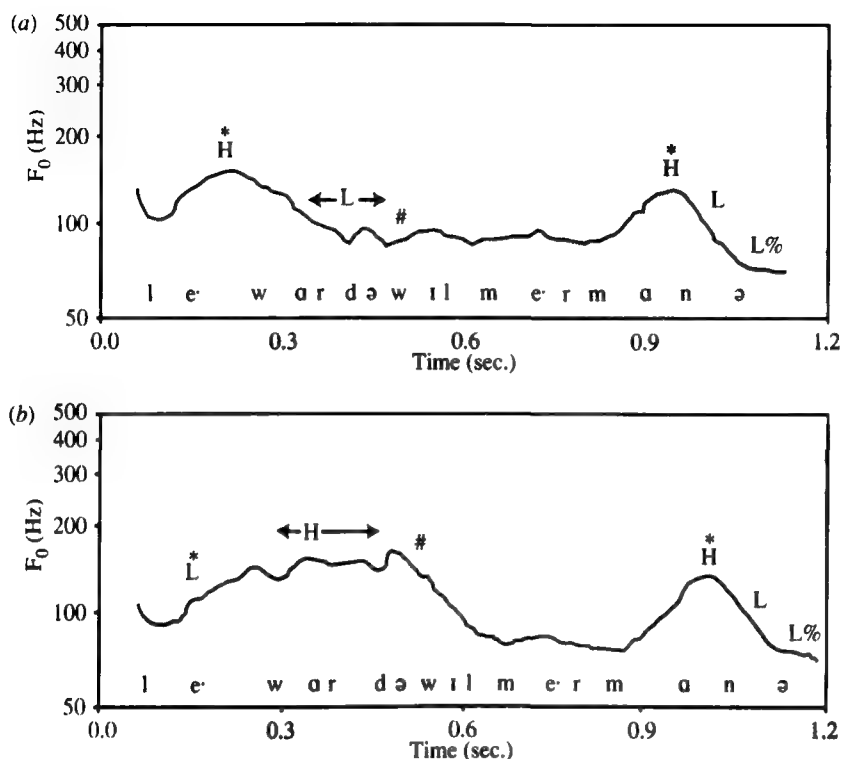


FIG. 7.2. Contours (H\*L)<sub>AD</sub>, (H\*L%)<sub>AD</sub>, and (L\*H)<sub>AD</sub> (H\*L L%)<sub>AD</sub> on the sentence *Leeu\*warden wil meer ma\*nnen*

there is also a phonetic realization possible in which the two phonological phrases in (49) do not each form an association domain (AD), but form only one such domain. The effect is that the tone following the starred tone is moved to the rest of a string before the next sentence accent (i.e., there is no second onset with its own L tone) (Fig. 7.3.)

#### 7.4. RHYTHMIC RULES

In Section 5.4. we encountered two types of stress shift, Trochaic Reversal (in compounds), and Stress Retraction (cf. Gussenhoven 1983a, 1983b; 1984). Stress Retraction is a postlexical rule that changes the stress patterns of attributively used adjectives and of prepositions, as in:

(50) *Adjectival compounds of the weak-strong type*

[dòod][zíek]	een dòodzìek kínd 'a critically ill child'
[stràat][árm]	een stràatarm méns 'a very poor person'



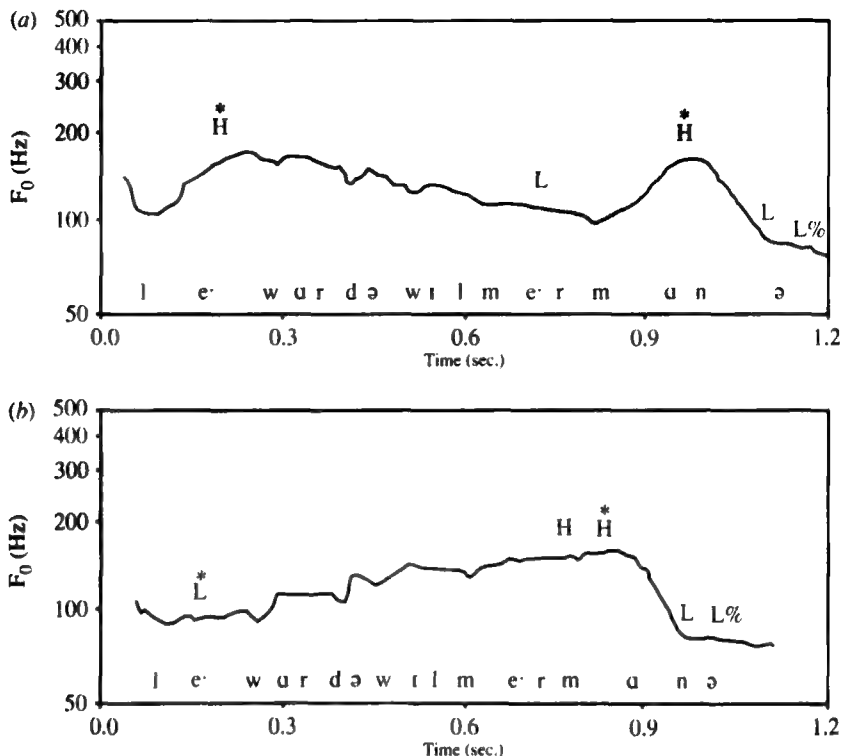


FIG. 7.3. Contours (H\*L H\*L L%)<sub>AD</sub>, and L\*H H\*L L%)<sub>AD</sub> on the sentence  
*Leeu\*warden wil meer ma\*n\*nen*

[zèlf][rɪjzend]      zèlfrijzend bákmeel 'self-raising flour'  
[nàuw][gezét]      een nàuwgezet fèmand 'a scrupulous person'

(51) *Prepositional compounds*

ònderáan      ònderaan de bérg 'at the foot of the mountain'  
bòvenóp      bòvenop de schúur 'on top of the shed'  
àchterín      àchterin de túin 'at the back of the garden'

Stress shift also occurs in the following cases, referred to as cases of Iambic Reversal (Gussenhoven 1984, Kager and Visch, 1988, Visch 1989) in order to distinguish it from Stress Retraction. Stress Retraction seems to be obligatory, while Iambic Reversal is optional, and its use is also determined by pragmatic factors, that is, it can be used as a rhetorical device in speeches in the case of attributively used adjectives (Gussenhoven 1983a, 1984):

(52) *Attributively used adjectives*

speciál      spèciaal gevál 'special case'  
feodáal      fèodaal stélsel 'feudal system'  
respectábel      rèspectabel mán 'respectable man'

(53) *Nouns before appositions*

admiráal	àdmiraal de Rúyter 'Admiral de Ruyter'
kardináal	kàrdinaal Simónis 'Cardinal Simonis'
Rotterdám	Ròtterdam-Zúid 'Rotterdam-South'

These examples show that stress clashes in the domain of the phonological phrase can be resolved by shifting the non-primary stress to the left. The relevant constituents can indeed be qualified as  $\phi$ s if single attributively used adjectives (i.e. non-branching APs) are assumed not to form a  $\phi$  of their own (Nespor and Vogel 1986). Note that it is thus correctly predicted that stress shift does not occur when the attributively used adjective is preceded by an adverb, and thus is the head of a branching AP:

(54) [een [zeer speciaal]<sub>AP</sub> geval]<sub>NP</sub> 'a very special case'  
 een zèer speciàal gevál, \*een zèer spèciaal gevál

Leftward stress shift is a case of Move \* in the domain of  $\phi$ , as illustrated here for the noun phrase (*een*) *doodziek kind* 'a critically ill child':

(55) ( (dood) <sub>ω</sub> (ziek) <sub>ω</sub> (kind) <sub>ω</sub> ) <sub>φ</sub>	
*            *            *	line 1
*            *            *	line 2
←            ⊕            *	line 3
	line 4

There is a stress clash here because two \*s are adjacent at the consecutive levels 2 and 3; the clash is resolved by stress shift to the left. This kind of stress shift is almost obligatory when the two constituents of the compound adjectives are simplex words, in other cases the shift is optional (Schultink 1979, Visch 1989: 107). Apart from that difference, one basic process is involved: leftward stress shift.

Stress shift does not occur when the primary stressed syllable of the first word is preceded by a single stressless syllable (cf. Visch 1989: 98–102):

(56) peníbel	*pènibel momént 'dangerous moment'
fantástisch	*fàntastisch gevóel 'fantastic feeling'
banáal	*bànaal grápje 'banal joke'
notáris	*nòtaris Kóster 'notary Koster'
colléga	*còllega Jánssen 'colleague Janssen'

This follows from the well-formedness conditions on grids: an asterisk cannot move to a position for which there is no asterisk at the next lower level (Prince 1983), as illustrated here for the first example, *penibel moment*, which is contrasted with a case of stress shift, *speciaal geval* 'special case':<sup>11</sup>

<sup>11</sup> The examples with the adjectives *fantastisch* and *concreet* also show that it is crucial for the explanation of the blocking of stress shift that their first syllables do not receive inherent stress, as would be predicted by theories that Dutch stress is quantity-sensitive (cf. Section 5.2.1). These examples are also problematic for analyses in which these word-initial syllables are considered as (monosyllabic) feet, because, again, within such theories the lack of stress shift is not explained.

(57)	((pe) <sub>σ</sub>	(ni) <sub>σ</sub>	(bəl) <sub>σ</sub>	ω	((mo) <sub>σ</sub>	(mənt) <sub>σ</sub>	ω	φ	
		*				*			line 1
		*				*			line 2
						*			line 3
	((spe) <sub>σ</sub>	(si) <sub>σ</sub>	(al) <sub>σ</sub>	ω	((γə) <sub>σ</sub>	(val) <sub>σ</sub>	ω	φ	
		*	*			*			line 1
	←		⊙			*			line 2
						*			line 3

Note the difference between bisyllabic adjectives such as *concreet* versus bisyllabic adjectives such as *doodziek*: the latter word is a compound, consisting of two prosodic words. Hence, the constituent *dood* does receive stress at lines 1 and 2, and thus forms a locus for stress shift.

In a few exceptional cases stress shift is possible in bisyllabic adjectives with an unstressed first syllable:

(58)	centraál	cèntraal	statióń	'central station'
	bináir	bínair	kenméřk	'binary feature'
	fináal	finaal	accéńt	'final stress'

These noun phrases may be considered as lexicalized expressions, and therefore subject to the rhythmic Hammock Principle which says that syllables at the edges of words preferably bear stress (cf. Section 5.2.1).

Some complex adjectives, in particular adjectives derived from nominal bases (including compounds) are exceptions to stress shift:

(59)	[ [vijánd] <sub>N</sub> ig] <sub>A</sub>	*vìjandige áanval	'enemy's attack'
	[ [ [eer] zúcht ] <sub>N</sub> ig] <sub>A</sub>	*èerzuchtig méisje	'ambitious girl'
	[ [ [grond] wét ] <sub>N</sub> elijk] <sub>A</sub>	*gròndwettelijk káder	'constitutional framework'

Note that the stress patterns of these adjectives are already marked in that the adjectival suffixes cause shift of the main stress of the base noun from the first syllable to the last stressable one before the suffix. The fact that morphological structure plays a role in the application of stress shift does not necessarily imply that word-internal morphological structure has to be visible at the postlexical level. We can mark these kinds of complex adjectives as exceptions to stress shift in the lexicon by means of a redundancy rule.

## CONNECTED SPEECH III: CLITICIZATION

### 8.1. INTRODUCTION

Clitics are function words such as pronouns, determiners, auxiliaries, particles, conjunctions, and prepositions which are phonologically dependent on a host word to which they attach, and with which they form a prosodic constituent. In addition, they may also have special syntactic distributional properties. For instance, the Dutch singular definite article *het* [hɛt] has a weak form which is a clitic: [ət]. Its syntactic distribution is determined by the rules for the construction of Dutch noun phrases, but phonologically it may be dependent on the preceding word in the sentence, its host. This is clear from the fact that it can form one domain of syllabification with the preceding word, as illustrated here for the sentence *Jan kocht het boek* 'John bought the book':

- (1) syntactic structure: [Jan]<sub>NP</sub> [kocht]<sub>V</sub> [t boek]<sub>NP</sub>  
 prosodic structure: (jan)<sub>ω</sub> ( (kɔx)<sub>σ</sub> (tət)<sub>σ</sub> )<sub>ω</sub> (buk)<sub>ω</sub>

The prosodic structure is non-isomorphic to the syntactic structure: the determiner [ət] depends syntactically on the following noun, and prosodically on the preceding verb.<sup>1</sup> The non-independence of [ət] follows from its phonological form, since it cannot form a prosodic word of its own. After its obligatory incorporation into the preceding prosodic word, resyllabification takes place according to the universal CV-rule (cf. Section 3.4.2). This process of resyllabification also blocks /n/-deletion when the host word ends in /ən/:

- (2) Zij kochten 't boek  
 (zɛi)<sub>ω</sub> ( (kɔx)<sub>σ</sub> (tə)<sub>σ</sub> (nət)<sub>σ</sub> )<sub>ω</sub> (buk)<sub>ω</sub>  
 'They bought the book'

Due to resyllabification the post-schwa /n/ no longer occurs in a coda, but in an onset, and hence it is saved from deletion.

If their structural descriptions are met, other P-rules that apply obligatorily within the prosodic word, also apply obligatorily in the host + clitic domain, in particular Homorganic Glide Insertion and Prevocalic Schwa Deletion:

<sup>1</sup> Cf. Klavans (1985) and Nevis (1988) for similar observations as to the non-isomorphism of prosodic and syntactic structure in the case of clitics. Sadock (1991) also argues that two structures are necessary in case of cliticization, but he does not qualify one of them as prosodic.

## (3) Homorganic Glide Insertion (HGI)

Ik zie 't boek

(ɪk)<sub>ω</sub> (sijət)<sub>ω</sub> (buk)<sub>ω</sub>

'I saw the book'

Ik doe 't werk

(ɪg)<sub>ω</sub> (duvət)<sub>ω</sub> (vɛrk)<sub>ω</sub>

'I do the chores'

## (4) Prevocalic Schwa Deletion

Ik merkte 't direct

(ɪk)<sub>ω</sub> (mɛrktət)<sub>ω</sub> (dirɛkt)<sub>ω</sub>

'I noticed it immediately'

It is also possible to insert an /n/ between the schwa and the next vowel:

(5) (ɪk)<sub>ω</sub> (mɛrktənət)<sub>ω</sub> (dirɛkt)<sub>ω</sub>

In all cases, the effect is that after incorporation of the clitic, the prosodic word fulfils all conditions on well-formed prosodic words.

These examples also illustrate that cliticization processes form part of the connected-speech phenomena.

## 8.2. PRONOMINAL AND ADVERBIAL CLITICS

The Dutch personal pronouns do not have the same distributional properties as full noun phrases (although they are syntactically equivalent to full noun phrases in that they denote arguments of the verb, and occur in prepositional and adverbial phrases), unless they are stressed, that is, bear a sentence accent, and have full ('strong') phonological forms. When they are unstressed and/or have a reduced ('weak') form, they are to be qualified as clitics. A survey of the Dutch system of personal pronouns is given in Table 8.1. The pronouns *hen* and *hun* in the last row differ in that the first is used as accusative and the second as dative.<sup>2</sup>

The full forms can be used in stressed and unstressed positions, with the exception of *het*. When they are stressed they have the same syntactic distribution as lexical noun phrases. The third-person pronouns are not only used to refer to animate beings, but also for referring to inanimate entities.

*Er* is the (suppletive) allomorph for *het* in prepositional phrases, and always occurs before the preposition;<sup>3</sup> it is also the adverbial pronoun for 'there':

<sup>2</sup> In substandard Dutch the pronoun *hun* is also used as the 3 pl. subject pronoun.

<sup>3</sup> The pronoun *er* and the following preposition are usually written as one word. Cf. Van Riemsdijk (1978) for a syntactic analysis of *er*.

TABLE 8.1. *The Dutch personal pronouns*

	Strong	Weak
1 sg. subj.	ik /ɪk/	ik /ɪk/, /ək/, 'k /k/
1 sg. obj.	mij /mɛi/	me /mə/
2 sg. subj.	jij /jɛi/	je /jə/
2 sg. obj.	jou /jɔu/	je /jə/
3 sg. subj. masc.	hij /hɛi/	ie /i/
3 sg. obj. masc.	hem /hɛm/	'm /əm/
3 sg. subj. fem.	zij /zɛi/	ze /zə/
3 sg. obj. fem.	haar /har/	'r /ər/, d'r /dər/
3 sg. neut.	het /hɛt/	't /t/, /t/
1 pl. subj.	wij /vɛi/	we /və/
1 pl. obj.	ons /ɔns/	
2 pl.	jullie /jɥli/	
3 pl. subj.	zij /zɛi/	ze /zə/
3 pl. obj.	hen /hɛn/, hun /hɥn/	ze /zə/

## (6) Het ligt er.

it lies there

'It's lying there.'

Ik lig [er op]<sub>PP</sub> /\*op het

I lie it on

'I'm lying on it.'

*Er* has the full forms /ɛr/ and the weak form /ər/. In contrast to the personal pronouns, the pronouns *het* and *er* cannot be used in stressed positions, not even in their full forms. Instead, the corresponding demonstrative pronouns *dat* /dat/ and *daar* /dar/ have to be used. The weak form of *daar*, /dər/, also functions as a stylistic variant of *er*.

The weak forms of these pronouns cannot be derived from the corresponding full forms by means of a productive phonological reduction rule. The general rule of Vowel Reduction (Section 6.4.) does not apply to diphthongs. Yet, the full forms of *mij*, *jij*, *zij*, and *wij* have corresponding weak forms with schwa. Also, a vowel cannot reduce after /h/ or in word-initial position. Nevertheless, the reduced form of *hem* is [əm], and *ik* has [ək] as one of its weak forms. Consequently, we have to list the weak forms as such in the lexicon. This means that they are 'special clitics' (cf. Zwicky 1977) in that they have opaque phonology. In addition, they also have special syntactic properties, as we see below, which means that they are also special clitics for syntactic reasons.

The conclusion that the weak forms have to be listed as lexical items is corroborated by the observations made by Berendsen (1986) and Zwart (1992) that in some contexts only the weak forms can be used. For instance, the weak

forms of the second-person singular and third-person plural pronouns, *je* and *ze* may have a generic interpretation, unlike the corresponding full forms:

- (7) *Ze/\*zij zeggen zoveel.*

'People say a lot.'

*Je/\*jij moet eerlijk zijn*

'One has to be honest.'

Furthermore, the strong third-person plural pronouns *zij*, *hen*, and *hun* can only be used to refer to animate entities or abstract entities like institutions, but not to other kinds of concrete entity. Idiomatic expressions often only allow for the use of the weak forms, as in:

- (8) *Ben je/\*jij gek?*

'Are you crazy?'

*Smeer əm/\*hem!*

'Clear off!'

Inversely, certain contexts require the strong form to be used, for instance after the preposition *volgens* 'according to', which requires prominence of its complement-noun phrase:

- (9) *volgens mij/\*me* 'according to me'

The weak form *je* is the only permissible second-person singular pronoun in pseudo-reflexive verbs such as *zich vergissen* 'to make a mistake' and *zich schamen* 'to be ashamed':

- (10) *Je vergist je/\*jou.*

'You are making a mistake.'

*Schaam je / \*jou!*

'Shame upon you!'

Pronominal clitics also exhibit syntactic properties that distinguish them from lexical NPs (Model 1991: ch. 10, Zwart 1992). For instance, adverbs such as *gisteren* 'yesterday' cannot stand before clitics, as illustrated in (11). Dutch clitics also exhibit 'clitic climbing', see (12):

- (11) *dat gisteren Jan/\*ie het boek gelezen heeft*

that yesterday John/he the book read has

'that yesterday, John/he read the book'

- (12) *\*dat ik de afwas Marie heb zien doen*

that I the dishes Mary have see do

'that I saw Mary doing the dishes'

*dat ik 't Marie heb zien doen*

that I it Mary have see do

'that I saw Mary doing it'

Furthermore, clitics cannot be conjoined:

TABLE 8.2. *Dutch singular possessive pronouns*

	Strong form	Weak form
'mine'	mijn /mɛin/	m'n /mən/
'your'	jouw /jɔu/	je /jə/
'his'	zijn /zɛin/	z'n /zən/
'her'	haar /har/	'r /ər/, d'r /dər/

(13) Ik zag hém en háar

\*Ik zag əm en ər

'I saw him and her'

Dutch singular possessive pronouns also have weak forms that only occur in unstressed position (Table 8.2). The possessive pronoun for 'its' only has the weak form /zən/. Again, the weak forms cannot be derived by rule, and have to be lexically listed. As was the case for personal pronominal clitics, the clitic forms can be used only in certain idiomatic expressions:

(14) in je eentje/\*in jouw eentje

'on your own'

op z'n best/\* op zijn best

'at best'

The adverbs *er* 'there', *daar* 'there', and *eens* 'once' also have clitic forms (Table 8.3). The use of the weak form is again lexicalized, as in \**Eens/es even kijken* 'Let's see.'

TABLE 8.3. *Dutch adverbial clitics*

	Strong form	Weak form
er 'there'	er /ɛr/	er /ər/, d'r /dər/
daar 'there'	daar /dar/	d'r /dər/
eens 'once'	eens /ens/	es /əs/

### 8.2.1. Prosodic integration

The question now arises how clitics are incorporated into prosodic structure. Except for *ie* /i/ and *ik* /ɪk/ all weak pronouns and adverbs have schwa as their only vowel (if any: there are also vowelless clitics, /k/ and /t/). This implies that they do not form prosodic words of their own (Section 3.6), but at most syllables, because a prosodic word requires at least one syllable with a full vowel. The fact that they are not prosodic words also explains why they cannot



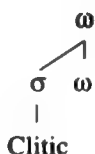
be stressed, since the domain of word-stress rules is the prosodic word. Moreover, syllables with schwa never bear word stress.<sup>4</sup>

Can we assume then that clitics form directly part of phonological phrases, without being dominated by a prosodic word node? This would be in conflict with the Strict Layer Hypothesis (Selkirk 1984*b*, 1986, Nespor and Vogel 1986) which says that

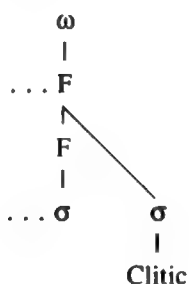
The prosodic categories are ordered in a hierarchy and in phonological representations they are strictly organized into layers according to that hierarchy i.e. prosodic constituents of the same category are not nested. (Selkirk 1986: 384)

This hypothesis excludes clitics, which are only syllables, from being directly dominated by a phonological phrase node. This means that clitics must either be Chomsky-adjoined to an adjacent prosodic word, as proposed in Neijt (1985), or incorporated into that prosodic word, that is, Chomsky-adjoined to a foot. The difference between the two solutions can be represented as follows:

(15)  $\omega$ -adjunction



F-adjunction



Logically, the mirror images of these adjunctions are also possible. However, it appears that in Dutch, proclitics are Chomsky-adjoined to prosodic words, and enclitics are Chomsky-adjoined to feet. Proclitics cannot adjoin to the following foot since a Dutch foot is a trochee, and hence cannot begin with a syllable with schwa, because it cannot function as the head of a foot. Enclitics, on the other hand, can adjoin to the preceding foot without violating the canonical structure of the left-headed feet of Dutch. Thus they exhibit the maximal degree of prosodic integration. In sum, proclitics have the same

<sup>4</sup> The fact that Dutch clitics do not form prosodic words also excludes an analysis analogous to that proposed by Nespor and Vogel for Italian clitics in which clitics are prosodic words that are dominated, together with their host word, by a node of the prosodic category Clitic Group (cf. Booij 1988*c*).

prosodic status as schwa-containing prefixes, and enclitics have the same prosodic status as suffixes.

Chomsky-adjunction still violates the Strict Layer Hypothesis in that a prosodic node is dominated by another one of the same category, but this is a very restricted type of violation. In the case of adjunction of a syllable to a prosodic word, we also skip one prosodic level.<sup>5</sup>

In principle, clitics can function both as enclitics and as proclitics. The only exceptions are the clitic *ie* and its allomorph *die*, and the pronominal clitic *der* /dər/ 'her' which are obligatory enclitics: that is, they require a host word on their left. Moreover, function words that contain a full vowel do not have to cliticize at all, since they can form prosodic words of their own. A clitic can be only a proclitic in sentence-initial position, and only an enclitic in sentence-final position.

In the case of schwa-initial clitics, there is clear evidence that these clitics can be incorporated into the preceding prosodic word, as illustrated here for the clitic /ət/ 'it' in sentence-final position:

(16) (Jan) ziet 't

prosodic structure: ( (zi)<sub>σ</sub>(tət)<sub>σ</sub> )<sub>ω</sub>

'John sees it.'

The basic observation here is that the clitic /ət/ induces obligatory resyllabification of the preceding word (the coda consonant /t/ of *ziet* becomes onset of the next syllable), because a syllable cannot begin with a schwa. Since the prosodic word is the domain of syllabification, the incorporation of the clitic into the preceding prosodic word predicts this obligatory resyllabification.

Another rule that applies in host + clitic combinations is /n/-insertion: after schwa, /n/ can be inserted to resolve the hiatus that arises when the clitic begins with a vowel (note that hiatus is resolved obligatorily in prosodic words only):

(17) ik zette-n-et 'I put it'	[ɪksetənət]
(hij) wilde-n-et 'he wanted it'	[vɪldənət]
wilde-n-ie 'wanted he'	[vɪldəni]
wilde-n-ik 'wanted I'	[vɪldənɪk]
(het) gekke-n-is 'the strange thing is'	[ɣɛkənɪs]

The fact that /n/-insertion also applies before vowel-initial clitics with a full vowel (*is*,<sup>6</sup> *ie*, *ik*) suggests that they can also be incorporated into the preceding prosodic word. Note that /n/-insertion does not apply between a clitic and a

<sup>5</sup> Itô and Mester (1992) have argued on the basis of Japanese that skipping of one level should be permitted. So they allow for unfooted syllables that are dominated directly by the prosodic word node. In such a theory, cohering suffixes and enclitics can be incorporated into the preceding prosodic word without being Chomsky-adjoined to a foot. However, this approach does not explain why there is a difference in the degree of prosodic integration between proclitics/prefixes and enclitics/suffixes.

<sup>6</sup> As will be shown below, auxiliaries like *is* also behave as clitics.

following word, as in *je eet lekker* 'you eat nicely' (\*[jənɛt]). Instead, the vowel-initial word after the clitic begins with a glottal stop: [jə ʔɛt]. In this respect proclitics exhibit the same behaviour as unstressed prefixes with respect to Prevocalic Schwa Deletion (cf. Section 7.1). In other words, the domain of /n/-insertion is the prosodic word. This supports the hypothesis that proclitics do not form one prosodic word with a following word, but are rather Chomsky-adjoined to them. Unlike Prevocalic Schwa Deletion, /n/-insertion only applies postlexically.

The resyllabification induced by the clitic bleeds /n/-deletion (cf. Section 6.8), a rule that deletes /n/ after schwa. For instance, the sentence *ze deden 't* 'they did it' has the phonetic form [zə dedənɛt]. It is impossible to first apply /n/-deletion, and then, after prosodic incorporation, Prevocalic Schwa Deletion, which would result in the wrong phonetic form [dedɛt]. This is an impossible pronunciation for the sequences (*zij*) *deden 't* '(they) did it'. These facts follow straightforwardly if the rules of connected speech such as /n/-deletion apply after the proper prosodic structure of a sentence has been created. The resyllabification induced by clitics puts the final /n/ in onset position, thus making it immune to /n/-deletion that only applies to /n/ in coda position.

In the case of the clitic *ie*, it is also possible to avoid the hiatus within the prosodic word by choosing the allomorph *die* instead of *ie*. The same applies to the clitic *er* for which the variant *d'r* can be used. However the hiatus may be resolved, the fact that it must be resolved somehow shows that these vowel-initial function words indeed form a prosodic word with the preceding word, obligatorily when it is *ie*, optionally in the case of the schwa containing clitics, *ik* and *is*. When vowel-initial clitics are not encliticized, a glottal stop is inserted before the vowel.

As pointed out above, when pronominal clitics occur in sentence-initial position, they can only cliticize to the following word. This also applies to clitics that consist of one consonant only (/k/, /t/) and clitics that begin with a consonant:

- (18) Er [ər] staat een paard in de gang.  
'There stands a horse in the corridor.'
- (19) 't gaat [ət xat] goed/'t gaat [txat] goed.  
'It goes well.'
- (20) Ik zal [ɪk sal] komen/'k zal [ksal] komen.  
'I will come.'
- (21) We eten [və ɛtən] lekker.  
'We eat nicely.'

In cases where the clitic is a proclitic, it is not incorporated into the following prosodic word, as is proved by the fact that the phonological rules discussed above that apply within the domain of the prosodic word, do not apply to such clitic + host combinations. (Recall the definition of dominance given in section 7.1!) For instance, Prevocalic Schwa Deletion does not apply obligatorily to

the schwa of *we* /ʊə/ in (21), since the sequence schwa–vowel is not dominated by the prosodic word node.<sup>7</sup> This follows from Chomsky-adjunction of the clitic to the following prosodic word. In the case of consonantal clitics this results in clusters such as /tʃ/ and /ks/ at the phonetic level, which we do not find at the lexical level.

When pronominal clitics can in principle take either the preceding or the following word as their host, it is enclisis that takes precedence over proclisis in the case of vowelless clitics.<sup>8</sup> This is clear from minimal pairs such as *zal'k eten* versus *zal keten* which can be perceptually distinguished (examples from Gussenhoven 1985):

- (22) (Dat) *zal'k eten*      (zalk)<sub>σ</sub>(e)<sub>σ</sub>(tən)<sub>σ</sub>  
       '(lit.) that will I eat' i.e., 'that I will eat'  
       (Jan) *zal keten*      (zəl)<sub>σ</sub>(ke)<sub>σ</sub>(tən)<sub>σ</sub>  
       'John will fool'

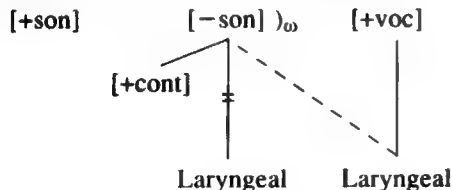
Another indication that consonantal clitics take a host on their left is that they cannot be used when the preceding word ends in a consonant; in those cases, the variant with preceding vowel has to be used:

- (23) *Ik pak* \*[t]/[ət] 'I fetch it.'  
       *Dat rol* \*[k]/[ɪk] 'That I roll.'

This constraint shows that there is a co-occurrence restriction between clitics and the preceding phonological material, which suggests that they form a unit with that material.

Clitics with a vowel (e.g., *er*, *ik*, *je*, *ze*, and *we*) can in principle also be integrated into the following prosodic structure, that is, their phonological structure permits them to act as proclitics. Evidence that schwa-initial clitics may function as enclitics is presented above. On the other hand, as pointed out by Gussenhoven (1985), there is also evidence that they do not always form part of the preceding prosodic word. This evidence concerns the process of Fricative Voice Assimilation discussed in Section 7.2.1: a prosodic word-final fricative may be voiced after a sonorant if the following word begins with a vowel, for example, in the compound *hui[z]arts* 'GP' and the phrase *lee[v] ik* '(lit.) live I'. The rule can be stated as in (24).

- (24) Fricative Voice Assimilation



<sup>7</sup> However, in casual speech the word-final schwa of function words may be deleted as in *we eten* /ʊə etən/ [ʊetən] 'we eat', and *de avond* /də avənd/ [dævənt] 'the evening'.

<sup>8</sup> Gussenhoven (1985) also argued that Dutch prefers enclisis to proclisis.

By interpreting this process as the spreading of the class node Laryngeal rather than the feature [+voice] we correctly predict that no other segment with a laryngeal specification can be inserted between the fricative and the following vowel. Thus, we account for Gussenhoven's (1985) observation that glottal stops cannot be inserted before the vowel-initial word after application of voicing since a glottal stop is crucially specified on the Laryngeal tier.

Gussenhoven (1985) concluded that clitics such as *er* do not necessarily belong to the preceding prosodic word, since Fricative Voice Assimilation may apply in relevant phrases. For instance, *geef er* 'give her' may be realized either as [ɣefər] or as [ɣevər]. In the first case, *er* is encliticized, in the second case it is not.

Evidence for consonant-initial clitics concerning their (optionally) functioning as enclitics is provided by the fact that they are subject to contraction processes in which it is always a host word on the left with which they are contracted. For instance, the complementizer *dat* 'that' contracts with a following clitic, dropping its final /t/:

- (25) *dat* 'k        [dʌk]  
       *dat* *je*        [dʌjə]  
       *dat* *ze*        [dʌsə]  
       *dat* *we*        [dʌvə]

Nevertheless, this does not necessarily mean that these words also encliticize when they do not contract. As we saw above, and as we will also see in Section 8.3, there is evidence that schwa-containing clitic words may be either enclitics or proclitics. In sum, we do not have to specify whether a Dutch pronominal clitic is an enclitic or a proclitic, except for *ie*, *die*, and *der*. That is, the latter are directional clitics.<sup>9</sup> Hence, *ie* does not have the same distribution as its strong counterpart *hij*, since the clitic cannot occur in sentence-initial position where no left host word is available. Therefore, this clitic must be subcategorized for occurring with a prosodic word on its left (Booij and Lieber 1993).<sup>10</sup> It induces obligatory resyllabification if the host ends in a consonant, which follows from the incorporation analysis proposed above:

- (26) *dat-ie* komt 'that he comes'                    (dʌ)<sub>σ</sub>(ti)<sub>σ</sub>(kɔmt)<sub>σ</sub>  
       *komt-ie?* '(lit.) comes he' i.e., 'does he come?'    (kɔmt)<sub>σ</sub>(ti)<sub>σ</sub>

### 8.2.2. Cliticization and Final Devoicing

Since Final Devoicing of obstruents in codas is a lexical word-level rule, and prosodic integration with concomitant resyllabification takes place at the post-

<sup>9</sup> Nespor and Vogel (1986) also make a distinction between non-directional and directional clitics.

<sup>10</sup> Similar clitics with a prosodic subcategorization frame are found in Serbo-Croatian, cf. Zec and Inkelas (1990).

syntactic level, it is predicted that word-final obstruents are voiceless even when they shift to onset positions. This indeed appears to be the case:

- (27) vond-ik /vɔnd ɪk/ 'found I'      phonetic form (vɔn)<sub>σ</sub>(tɪk)<sub>σ</sub>  
       vond-ie /vɔnd i/ 'found he'      phonetic form (vɔn)<sub>σ</sub>(ti)<sub>σ</sub>  
       vond et /vɔnd ət/ 'found it'      phonetic form (vɔn)<sub>σ</sub>(tət)<sub>σ</sub>

However, there appears to be variation here (Berendsen 1983, 1986; Booij 1985b) in that for certain frequent verbs the variants with voiced obstruents are also found, but only in cases where there is an underlying stem-final voiced obstruent. This suggests that certain verb+clitic combinations are lexically stored.<sup>11</sup> Consequently, the resyllabification induced by the attachment of the clitic will bleed the word-level rule of Final Devoicing:

- (28) heb-ik 'have I'  
       lexical clitic:        /heb ɪk/    (hɛ)<sub>σ</sub>(bɪk)<sub>σ</sub>  
       postlexical clitic: /hɛp ɪk/    (hɛ)<sub>σ</sub>(pɪk)<sub>σ</sub>

Less frequent verbs with stem-final voiced obstruents such as *verbind* 'to connect', *verwond* 'to injure', and *vermoord* 'to murder' do not surface with a voiceless obstruent before the clitic:

- (29) verbind-ik        [vərbɪntɪk], \*[vərbɪndɪk]  
       verwond 'r        [vəruɔntər], \*[vəruɔndər]  
       vermoord 'm        [vərmɔ:rtəm], \*[vərmɔ:rdəm]

This supports the lexicalization hypothesis for frequent verbs like *hebben* 'to have'. As we will see in Section 8.4, there are more cases of lexical listing of verb + clitic combinations in Dutch.<sup>12</sup>

A special property of *ie* is that it never occurs after a stem-final /d/. For instance, the only possible phonetic realization of *vond-ie* 'found he' is [vɔnti]; \*[vɔndi] is impossible. This restriction is related to the fact that the allomorph /di/ always surfaces as [ti] after an obstruent:<sup>13</sup>

- (30) keek-[i], keek-[ti], \*keek-[di]      'watched he'  
       gaf-[i], gaf-[ti], \*gaf-[di]        'gave he'

In this respect /di/ differs from other /d/-initial function words which can either voice a preceding voiceless obstruent or be devoiced themselves after voiceless obstruents, as discussed in the next section. The weak form of the pronoun *haar*, /dər/, is also obligatorily subject to devoicing after an obstruent. In other

<sup>11</sup> A similar variation is found for combinations of 'to have' and clitics in German, cf. Wiese (1996). Note also that in Middle Dutch, which had no standard orthography, such frequent verb + clitic combinations were written as one word, e.g. *hebbic* 'have I' (cf. Van Kerckvoorde 1993: 14–17 for a survey).

<sup>12</sup> In Booij and Rubach (1987) evidence for the existence of lexical attachment of clitics is provided for Dutch and Polish.

<sup>13</sup> This observation was made in Zonneveld (1983) and Gussenhoven (1985). Berendsen (1983) accounts for these facts as follows: the clitic /i/ is derived from an underlying form that begins with a dental fricative. A special rule converts the sequence alveolar stop + dental fricative into a [t]. This rule is ordered before the rule that derives [i] from this underlying form.



*die*. When the syllable node that it dominates is adjoined to the last foot of the preceding prosodic word, the dominating prosodic nodes will be erased automatically, because a syllable cannot simultaneously belong to two feet or prosodic words.

The consequence of these alternations is that in a sentence like *Ik geef er niet om* 'I do not care about it' the word sequence *geef er* may have four different phonetic realizations given the fact that the clitic /ər/ has an allomorph /dər/ which may be subject to devoicing (Gussenhoven 1985: 187):

(34) *geef er*: [xɛfər], [xɛvər], [xɛftər], [xɛvdər]

The second form has a [v] derived by Fricative Voice Assimilation. Note that this rule does not apply to sequences such as *gaf-ie* 'gave he' with the obligatory enclitic *ie*, since there is no prosodic word boundary after the fricative. Thus, as pointed out in Gussenhoven (1985), [ɣavi] is impossible.

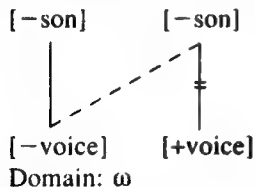
The personal pronoun *die*, the allomorph of *ie*, has to be marked as being obligatorily encliticized, hence it always surfaces as [ti]. Note that we observed above that the allomorph *ie* is also an obligatory enclitic. The determiner *de* always surfaces as [tə] after a word-final /t/, which means that it is obligatorily encliticized in that position:

(35) (Ik) lees de (krant) 'I read the paper' [lestə], [lezdə]  
(Hij) leest de (krant) 'He reads the paper' [lestə], \*[lezdə]

When encliticization does not apply, the function words are prosodically integrated into the following phonological phrase. This analysis implies that, for clitics with more than one potential host word, encliticization is optional, and they may also procliticize to the following word. Except for *de* and *d'r* these /d/-initial function words contain a full vowel, and therefore do not necessarily require a host word.

The rule that devoices the first consonant of these encliticized function words is given in (36).

(36) Word-internal Devoicing



Note that this rule does not apply to obstruents preceded by the clitics /k/ and /t/ when used as proclitics before a voiced obstruent as in '*k ben* [kβɛn] 'I am' or '*t begint* [tβəɣɪnt] 'it begins'. This supports the idea that such consonantal proclitics are not integrated into the following prosodic word, but are rather Chomsky-adjoined to it.

Prepositions always contain at least one full vowel, except *te* /tə/ 'at'. Hence, they do not require a host word. Yet, it appears that they do encliticize



(37) (fietste-in)<sub>w</sub>    Prevocalic Schwa Deletion: [fitstɪn]  
                                /n/-insertion:                      [fitstənɪn]  
      (fietste)<sub>w</sub> (in)<sub>w</sub>    [fitstə ?ɪn]

(38) *het bos in* '(lit.) the wood into' i.e., 'into the wood' [ədbɔzɪn]

(39) Het gekke is 'The strange thing is'

**/n/-insertion:** [ətɛkənɪs]

**Prevocalic Schwa Deletion:** [ətɪkɪs]

**No encliticization:** [ətɛkə ʔis]

The conjunction *en* 'and' has the weak form [ən] in number terms below 100 which are formed by co-ordination. For instance, in *twee-en-twintig* '(lit.) two and twenty' ('twenty-two') we get this weak form of *en*. This schwa-initial weak form also appears to be incorporated into the preceding prosodic word, and this triggers Homorganic Glide Insertion: the phonetic form in this case is [twejəntwɪntəx].

#### 8.4. CONTRACTION

**Certain sequences of function words can be contracted: *dat* ‘that’ + personal pronoun, auxiliary/modal verb + pronoun, and certain auxiliaries preceded by a pronoun:**

- (40) *dat* + pronoun  
*dat* 'k → [dɔk]  
*dat* je → [dɔjə]  
*dat* ze → [dɔsə]  
*dat* we → [dɔvə]

The regularity involved here is that it is the final /t/ of *dat* that is deleted before the clitic. We also find even stronger forms of contraction like [dɔj] for *dat je* and [dɔv] for *dat we*.

In the case of pronouns it is the weak form 'k that induces contraction, causing deletion of the final consonant of the first word:

(41) modal verb/auxiliary	+	pronoun
wil 'k 'want I'	→	[vɪk]
zal 'k 'will I'	→	[zək]
kan 'k 'can I'	→	[kən̩k]
moet 'k 'must I'	→	[muk]
mag 'k 'may I'	→	[mæk]
heb 'k 'have I'	→	[hɛk]

In the case of *je*, the final consonant of the first word can be deleted, and even the final schwa of the pronoun. Such forms are typically sub-standard Dutch:

(42) wil je	[vɪjə], [vɪj]
zul je	[zʏjə], [zʏj]
kan je	[kən̩jə], [kən̩j]
moet je	[muɣjə], [muɣj]
mag je	(no contraction)
heb je	[hɛjə], [hɛj]
ben je	[bɛjə], [bɛj]

The generalization that can be made is that the first of two adjacent consonants deletes:

(43) [+cons] → ∅ / ( . . . — [+cons] . . . ) <sub>ω</sub>
---

This formulation of the rule presupposes that the second word is encliticized to the preceding word. The rule is lexically governed: it only applies to a specific set of verbs + pronouns. Alternatively, one may list these contracted forms as such in the lexicon. After application of consonant deletion, it is also possible to delete the final schwa. Without consonant deletion, deletion of the schwa would lead to ill-formed word-final consonant clusters like *-nj* and *-tj*.

As pointed out by Gussenhoven (1985), forms of the verbs *hebben* 'to have' and *zijn* 'to be' contract with preceding pronouns:<sup>14</sup>

(44) ik heb 'I have'	[ɪkɛp]
'k heb 'I have'	[kɛp]
je hebt 'you have'	[jɛpt]
hij heeft 'he has'	[hɛift]
ze heeft 'she has'	[zɛft]
we hebben 'we have'	[ʋɛbən]
ze hebben 'they have'	[zɛbən]

The disappearance of the /h/ is predictable: in such clitic + verb combinations the /h/ will be preceded or followed by another consonant, whereas it is impossible for the /h/ to occur in consonant clusters. For instance, the form /zheft/ for *ze heeft* is phonotactically impossible.

<sup>14</sup> According to Gussenhoven (1985) the verb *hoeven* 'to need' may also be subject to contraction, for instance, in the idiolect of the author of that article.

Note that contraction does not apply to all /h/-initial words. For instance, *je houdt* 'you hold' cannot be pronounced as [jɔʊt].

The only complication left is that in *hij heeft* 'he has' it is the diphthong that survives whereas normally the vowel of the clitic pronoun is dropped. If the diphthong of *hij* were deleted, the resulting contracted form would be homophonous with the phonetic form of *heeft* 'has'.

The possibility of contraction in combination with the use of weak forms of pronouns leads to a number of alternative phonetic realizations of word sequences that may be quite distant from their written forms, as in:

- (45) Ik heb het hem (gezegd) '(lit.) I have it him told' ('I told it to him')  
 [ɪkhepətəm], [ɪkheptəm], [ɪkepətəm], [ɪkeptəm], [kepətəm], [keptəm]

The verb form *is* 'is' can appear in the form /s/, but only after function words, which suggests that it is to be interpreted as a form of contraction in function-word sequences.<sup>15</sup>

- (46) Dat is jammer 'That's a pity' [dats], [das]  
 Jan is ziek 'John's ill' \*[jans], [janɪs]  
 Hij is ziek 'He's ill' [heɪs]  
 Zij is rijk 'She's rich' [zeɪs]

Contracted forms with /s/ can also undergo further contraction, that is, they may also exhibit reduction in the preceding function word, as in:

- (47) Dat's (jammer) 'That's a shame' [das]  
 Dit's (lekker) 'This is nice' [dɪs]  
 Wat's dat? 'What's that?' [wazdat] or [wastat]

The rule of consonant deletion (43) takes care of these contraction cases as well. As will be clear again from the data presented here, contraction is a lexically governed process. For instance, we do not find consonant deletion in a lexical word:

- (48) (De) kat is (ziek) [katɪs], \*[kats], \*[kas]

Since contraction is restricted here to pronouns + *is*, it is possible to list the contracted forms in the lexicon, although certain phonological generalizations about the contraction patterns can be made, as shown above.

<sup>15</sup> Contraction is not possible when there is a movement of deletion site in the sequence of function words, as in:

(a) Ik weet niet wie zij *is* 'I do not know who she is'

in which the sequence *zij is* cannot be realized as [zeɪs]. This suggests sensitivity to the presence of traces and also that contraction should not be interpreted as a prosodic rule since prosodic rules are not sensitive to the presence of empty elements in syntactic (surface) structure (Nespor and Vogel 1986).

However, as pointed out in Gussenhoven (1985: 182) contraction is also impossible when the movement site follows the sequence of function words. This point is supported by the fact that in the English equivalent of (a), with SVO word order, contraction of *she is* to *she's* is also impossible, although the trace of *who* follows the sequence of function words. This matter therefore deserves further investigation.

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## ORTHOGRAPHY

### 9.1. INTRODUCTION

At first sight, it may seem rather strange to deal with the orthography of a language at the end of a book on its phonology rather than at the beginning. The reason behind this organization of the book is that the orthography of Dutch cannot be understood properly without knowledge of the phonological system of Dutch as described in the preceding chapters. In particular, the syllable structure of words plays a crucial role in the orthographic representations of vowels and consonants. Moreover, Dutch does not always represent the phonetic form of words. Instead, some more abstract level of phonological representation is reflected by the spelling, and this more abstract level appears to be only definable in terms of the typology of phonological rules developed in Chapters 4 to 7.

### 9.2. THE CORRESPONDENCE BETWEEN SOUNDS AND LETTERS

The first problem for Dutch orthography is the lack of a sufficient number of letters for its sounds. This applies in particular to vowels: there are only five vowel letters (*i, u, e, o, a*) for the thirteen Dutch vowels, the diphthongs not included. This has the effect that there is no one-to-one correspondence between sounds and letters. The lack of one-to-one correspondence is increased by the fact that the history of words also plays a role in their spellings. This does not only apply to loan-words that often keep their original spelling, but also to native words, the spelling of which may reflect an older stage of Dutch, as will be illustrated below. The historical background of Dutch orthography is discussed in detail in Booij *et al.* (1979).

The spelling of the consonants is more straightforward. Complications only arise because there are two digraphs, *ch* for /x/, and *ng* for /ŋ/, and because of the etymology effect. A survey of the spelling of the Dutch consonants is given in Table 9.1.

Ambisyllabic consonants, that is, intervocalic consonants occurring after a short vowel, are spelled as geminates, but digraphs cannot be geminated (this also applies to vowel digraphs):

TABLE 9.1. *The spelling of consonants*

Consonant	Spelling	Special cases
/f/	f	ph ( <i>phoenix</i> 'id.') v ( <i>veertig</i> 'forty', <i>vijftig</i> 'fifty')
/v/	v	
/s/	s	c ( <i>cent</i> 'id.') ç ( <i>façade</i> 'id.') sc ( <i>scene</i> 'id.') sch (suffix <i>-isch</i> as in <i>logisch</i> 'logical') z ( <i>zestig</i> 'sixty', <i>zeventig</i> 'seventy')
/ʃj/	sj	ch ( <i>chef</i> 'id.') sh ( <i>shilling</i> 'id.') s ( <i>analyse</i> 'analysis', <i>fase</i> 'phase')
/z/	z	
/ʒj/	zj	g ( <i>horloge</i> 'watch') j ( <i>jury</i> 'id.')
/x/	ch	
/ɣ/	g	gh ( <i>yoghurt</i> 'id.')
/p/	p	
/b/	b	
/t/	t	th ( <i>thee</i> 'tea')
/d/	d	ddh ( <i>Boeddha</i> 'Buddha')
/k/	k	c ( <i>café</i> 'id.') ch ( <i>christen</i> 'Christian') qu ( <i>quotient</i> 'id.')
/kv/	kw	qu ( <i>quiz</i> 'id.')
/ks/	ks	cc ( <i>accent</i> 'id.') x ( <i>taxi</i> 'id.')
/m/	m	
/n/	n	
/ŋj/	nj	gn ( <i>campagne</i> 'campaign')
/ŋ/	ng	n before velar consonants ( <i>bank</i> 'id.')
/l/	l	
/r/	r	
/v/	w	uw after ie ( <i>nieuw</i> 'new') and ee ( <i>leeuw</i> 'lion')
/j/	j	i after vowels ( <i>mooi</i> 'beautiful') ij in proper names ( <i>Booij</i> 'id.') y ( <i>royaal</i> 'generous') ill ( <i>failliet</i> 'bankrupt')

- (1) *kikker* /kikər/ 'frog'  
*jekker* /jekər/ 'coat'  
*hутten* /hʏtən/ 'huts'  
*botten* /bɔtən/ 'bones'  
*bakker* /bəkər/ 'baker'

but:

lachen /laxən/ 'to laugh'

zingen /zɪŋən/ 'to sing'

The spelling of short vowels is straightforward (Table 9.2). However, the spelling of long vowels is complicated (Table 9.3). The generalization is that long vowels are spelled as single letters in open syllables (including word-final position), and as geminates in closed syllables, that is, in syllables in which the vowel is followed by at least one consonant. However, *oe* and *eu* cannot be geminated because they are digraphs. Moreover, the geminate form of *i* is *ie* rather than *ii*. In the case of /e/, it is also spelled as a geminate *ee* in word-final position in order to avoid confusion with the schwa which is spelled as *e* in that position. In the case of /i/ the geminate spelling *ie* is used in open syllables as well, namely in native words.

TABLE 9.2. *The spelling of short vowels*

Short vowels	Vowel Spelling
/ɪ/	i
/ɛ/	e
/ʊ/	u
/ɔ/	o
/a/	a

Long vowels before a consonantal digraph are spelled as geminates, although from the phonological point of view they may stand in an open syllable. Therefore, a word like *goochem* /ɣoxəm/ 'smart' is spelled with *oo*. The reason is that before consonantal digraphs a single vowel letter is interpreted as a short vowel, as pointed out above.

The schwa is usually spelled as *e*. Exceptions are words like *monnik* 'monk' and suffixes such as *-ig* /ɔɣ/ where *i* is used, and *-lijk*, where *ij* stand for the schwa. In the indefinite determiner *een* /ən/, the schwa is represented by the geminate *ee*. In geographical names such as *Dokkum* 'id.' the schwa is spelled as *u*. Since the schwa patterns with long vowels, we do not find consonantal geminate letters after letters standing for schwa, as illustrated by the following words:

- |                        |           |
|------------------------|-----------|
| (2) bezemen 'to sweep' | /bezəmən/ |
| monniken 'monks'       | /mɔnɔkən/ |
| Dokkumer 'of Dokkum'   | /dɔkəmər/ |

The three diphthongs of Dutch are spelled as sequences of two letters (Table 9.4). Complications arise, because etymology plays a role in their spelling. The diphthong /ɛi/ is spelled as *ei* when it derives historically from Proto-Germanic /ui/, and as *ij* when it derives from long /i/. Thus, we get orthographical

TABLE 9.3. *The spelling of long vowels*

Vowel	Spelling
/i/	i (in open syllables, e.g. <i>liter</i> 'litre') ie (in closed syllables and in native words, e.g. <i>Piet</i> 'Pete', <i>Pieter</i> 'Peter') y (in loan-words, e.g. <i>mythe</i> 'myth') ij (only in <i>bijzonder</i> 'special')
/y/	u (in open syllables and before /w/, for example, <i>vuren</i> 'fires', <i>uw</i> 'your') uu (in closed syllables, e.g. <i>vuur</i> 'fire')
/u/	oe ou (in loan-words, e.g. <i>douane</i> 'customs')
/e/	e (in open syllables, e.g. <i>beter</i> 'better') ee (in closed syllables and at the end of a (prosodic) word, e.g. <i>beet</i> 'bite', <i>trofee</i> 'trophy', <i>meewarig</i> 'compassionate') é (in loan-words, e.g. <i>café</i> 'id.')
/ɛ/	er (in loan-words, e.g. <i>diner</i> 'dinner')
	ai (in loan-words, e.g. <i>container</i> 'id.')
	ae (in loan-words, e.g. <i>Aesopus</i> 'id.')
/œ/	eu oe (in loan-words, e.g. <i>oedeem</i> 'oedema')
/o/	o (in open syllables) oo (in closed syllables) eau (in loan-words, e.g. <i>bureau</i> 'desk')
	oi (in geographical names, e.g. <i>Oirschot</i> 'id.')
	au (in loan-words, e.g. <i>auto</i> 'car')
/a/	a (in open syllables) aa (in closed syllables)

minimal pairs like *leiden* 'to lead' versus *lijden* 'to suffer'. The same applies to the diphthong /ɔu/ which is spelled as *ou* when it derives from the sequence /ɔl/, and *ou* or *au* otherwise. Sometimes, the off-glide [ʊ] at the end of the diphthong is also represented in the spelling.

The consequence of this system is that many orthographical forms have to be memorized by the writer of Dutch since for many words, their orthographic form is not predictable from their phonological form.

Sequences of vowel letters may cause problems as to their proper interpretation. For instance, the sequence *ei* occurs in both *gein* /ɣeɪn/ 'fun', where it stands for a diphthong, and in *geind* /ɣəɪnd/ 'collected', where it stands for the sequence schwa + /i/. Therefore, Dutch spelling uses diaeresis, two dots above a vowel letter, to indicate the proper interpretation, as in *gein* versus *geïnd*. Another example is *reël* /reɪl/ 'real' versus *reeën* /reɛn/ 'deer' (pl.) (cf. Wester 1985 for detailed discussion of the diaraesis system). A related principle concerns the spelling of /i/ before schwa: when /i/ is spelled as *ie*

TABLE 9.4. *The spelling of diphthongs*

Diphthong	Spelling
/ɛi/	ei (e.g. <i>ei</i> 'egg') ij (e.g. <i>ij</i> 'water')
/ɔu/	ou (e.g. <i>nou</i> 'now') au (e.g. <i>au</i> 'ouch!') ouw (e.g., <i>gouw</i> 'province') auw (e.g., <i>nauw</i> 'narrow')
/æy/	ui (e.g. <i>ui</i> 'onion') eui (in loan-words like <i>fauteuil</i> 'armchair') eu (e.g. in <i>neuron</i> 'id.')

in word-final position, and does not bear word stress, it is reduced to *i*. Thus we get the following difference:

- (3) *genie* 'genius'      *genieën* (pl.)  
       versus  
       *ólie* 'oil'          *oliën* (pl.)

A final complication is the use of the diacritic '. This diacritic is used to represent the genitive suffix /s/ after a stem ending in *s*. Thus we get:

- (4) *Jans* boek 'Jan's book' (= the book of Jan)  
       versus  
       *Jans'* boek 'Jans's book' (= the book of Jans)

When the plural suffix /s/ is added to a word ending in a single vowel letter, the corresponding letter *s* is preceded by the diacritic ' in order to guarantee the correct phonetic interpretation of the vowel letter as standing for a long vowel: *kano's* 'canoes', *pyjama's* 'pyjamas', *rabbi's* 'id.', *reçu's* 'receipts'.

### 9.3. DEGREES OF ABSTRACTNESS IN SPELLING

Dutch orthography abstracts away from the effects of certain phonological rules. For instance, the spelling of the word *hond* 'dog' represents the underlying form /hɔnd/ instead of the phonetic form [hɔnt]. Traditionally, this kind of abstractness is described as the 'principle of uniformity' which says that morphemes should always have the same orthographical form. However, as we will see below, this principle is not applied consistently in Dutch orthography.

Crucial for a proper characterization of the degree of abstractness of Dutch spelling is the rule typology as presented in the preceding chapters (cf. Booij 1987b). The first generalizations are: (a) the effects of the rules of connected speech including those of voice assimilation are never represented in the spelling; (b) the effects of the morpholexical rules of word phonology are always represented in the spelling.



For instance, Dutch spelling abstracts away from the effects of the rules of Regressive and Progressive Voice Assimilation, whether they apply in compounds or in phrases. Also, the insertion of schwa in coda clusters is never represented. On the other hand, the allomorphy of the diminutive suffix is always represented in Dutch spelling. This makes sense since there are sometimes two allomorphs, as in the case of *bloempje* 'little flower' versus *bloemetje* 'bunch of flowers'. In other words, by representing the effects of morpholexical rules in the spelling, it is guaranteed that the phonological form of a word can be recovered from its orthographical form.

As far as the effects of the P-rules of word phonology are concerned, things are more complicated because these effects are partially represented in the spelling.

The effects of Final Devoicing are only represented orthographically for underlying /z/ and /v/, that is, they are spelled as *s* and *f* respectively when devoiced. In the case of /b/, /d/ and /ɣ/ it is always the underlying form that is spelled:

- (5) /v/ *dief* /div/ [dif]—*dieven* [divən] 'thief/thieves'  
 /z/ *kaas* /kaz/ [kas]—*kazen* [kazən] 'cheese/cheeses'  
 /b/ *tob* /tɔb/ [tɔp]—*tobben* [tɔbən] 'to toil' (1 pers. sg./pl.)  
 /d/ *zaad* /zad/ [zat]—*zaden* [zadən] 'seed/seeds'  
 /ɣ/ *vlag* /vlɑɣ/ [vlɑx]—*vlaggen* [vlɑɣən] 'flag/flags'

A related complication is that /v/ and /z/ are even spelled as *s* and *f* in past-tense forms of verbs with a voiced fricative in stem-final position, although these fricatives are always voiced in that position:

- (6) *beefde* /bev+də/ [bevðə] 'shivered' (sg.)  
*raasde* /raz+də/ [razðə] 'raged' (sg.)

In the case of Nasal Assimilation, its effect on the place of articulation of nasal consonants is not represented for the palatal and the velar nasal, but it is represented for the bilabial nasal:

- (7) [m] *damp* [damp] 'id.'  
 versus  
 [ɱ] *Spanje* [spɑɱjə] 'Spain', [ŋ] *bank* [baŋk] 'id.'

The effects of the rule of Degemination are not represented in the spelling, except when we would get a geminate consonant at the end of a (prosodic) word. Compare:

- (8) *voedde* /vud+də/ [vudə] 'fed' (past)  
*achtte* /ʌxt+tə/ [ʌxtə] 'considered' (past)  
*wordt* /vɔrd+t/ [vɔrt] 'becomes'  
 versus  
*eet* /et+t/ [et] 'eats'  
*gevoed* /ɣə+vud+d/ [ɣəvut] 'fed' (part.)  
*(iets) vies* /viz+s/ [vis] '(something) dirty'

In the last example, the /z/ is devoiced, and hence spelled as *s*. This would give rise to the letter sequence *ss*, which is subsequently subject to degemination in the orthographical sense. On the other hand, the sequence *dt* is kept, although it is also subject to degemination in the phonological sense, and realized as [t], because Dutch orthography does not represent the effect of Final Devoicing on /d/. In other words, *-dt* represents the underlying form of the phonological derivation.

As far as the hiatus rules of word phonology are concerned, a difference has to be made between Prevocalic Schwa Deletion and Homorganic Glide Insertion. The effects of the first rule are always represented in spelling, the effects of the second rule never. We do find intervocalic glides spelled in words like *koeien* [kujən] 'cows' and *vlooien* [vlojən] 'fleas', but this is precisely because these glides are unpredictable, the predictable glide in these cases being the [ʊ]. Table 9.5 summarizes the way in which the effects of the P-rules of word phonology are represented orthographically:

TABLE 9.5. *Survey of orthographical representation of P-rule effects*

P-rule	Effect represented	Effect not represented
Final Devoicing	for /v, z/	for /b, d, ɣ/
Laryngeal Spreading	always	
Nasal Assimilation	for [m]	for [ɲ, ŋ]
Degemination	word-final position	word-internal position
Prevocalic Schwa Deletion	always	
Homorganic Glide Insertion		always

#### 9.4. SPELLING AND HIGHER-ORDER LINGUISTIC STRUCTURE

Dutch orthography also provides syntactic and semantic information. Capital letters mark the beginning of sentences and proper names. Punctuation is used to mark the boundaries between certain syntactic constituents (e.g. clauses and appositional and parenthetical constituents), and spacing is used to mark word boundaries. Compounds are always written as one word. That is, the fact that compounds are one word from the grammatical point of view is represented in the spelling. This is different from English where many compounds are spelled with word-internal spaces. This means that in English spelling, spacing often reflects prosodic structure rather than grammatical structure (recall that compounds consist of two or more prosodic words). However, there is also a tendency among Dutch writers to write compounds with internal spaces between the prosodic words.

Hyphenation, the use of hyphens in word-splitting, on the other hand, is based on the prosodic structure of words, not on their morphological structure

(as is the case in English) as is illustrated by the hyphenation of the word *morphemic* and its Dutch counterpart:

(9) English: morphem-ic

Dutch: mor-femisch or morfe-misch

That is, in Dutch the hyphen has to coincide with a syllable boundary. In the case of consonantal geminates and consonantal digraphs after short vowels the hyphen is inserted in the middle of the sequence, except for the digraph *ch*:

- (10) baker        ba-ker 'nurse'  
       bakker      bak-ker 'baker'  
       zanger      zan-ger 'singer'  
       lachen      la-chen 'to laugh'

In sum, the spelling conventions of Dutch illustrate that orthography represents a lot more than just the spoken forms of words.

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<i>CLS</i>	<i>Papers from the nth Regional Meeting of the Chicago Linguistic Society</i>
<i>IULC</i>	Indiana University Linguistics Club
<i>JL</i>	<i>Journal of Linguistics</i>
<i>JoP</i>	<i>Journal of Phonetics</i>
<i>LB</i>	<i>Leuvense Bijdragen</i>
<i>Lg.</i>	<i>Language</i>
<i>LI</i>	<i>Linguistic Inquiry</i>
<i>LIN</i>	<i>Linguistics in the Netherlands</i>
<i>NLLT</i>	<i>Natural Language and Linguistic Theory</i>
<i>Ntg.</i>	<i>De Nieuwe Taalgids</i>
<i>Ph.</i>	<i>Phonology (Yearbook)</i>
<i>Sp.</i>	<i>Spektator, tijdschrift voor Neerlandistiek</i>
<i>YM</i>	<i>Yearbook of Morphology</i> , edited by Geert Booij and Jaap van Marle

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ISBN 0-19-823869-X



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